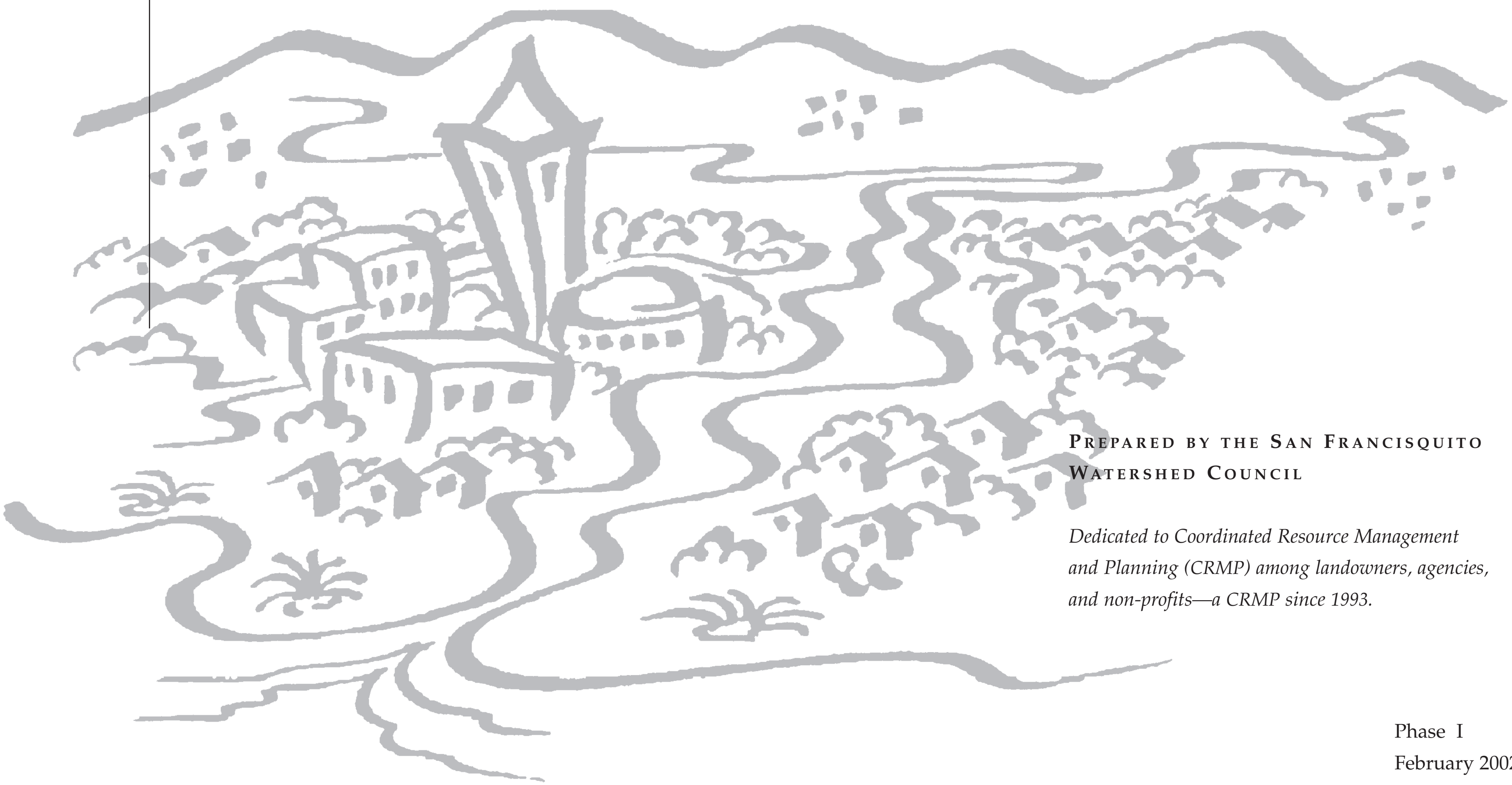
Long-Term Monitoring and Assessment Plan for the San Francisquito Creek Watershed



PREPARED BY THE SAN FRANCISQUITO WATERSHED COUNCIL

Dedicated to Coordinated Resource Management and Planning (CRMP) among landowners, agencies, and non-profits—a CRMP since 1993.

Phase I
February 2002

Preface

This version of the Long-Term Monitoring and Assessment Plan (LTMAP) is subtitled "Phase I" because the LTMAP document itself is just part of a process to design and establish a scientifically based adaptive management process that will assist decision-makers in the watershed. During development of the document, the LTMAP work group foresaw the need for several significant follow-up tasks if such a process was truly to be established. The San Francisquito Watershed Council is committed to accomplishing these tasks, which include:

- establishing the rest of the fixed-station monitoring network in order to provide data representative of the whole watershed, including the upper portions;
- creating a scientific coordination and adaptive management process to review, synthesize, and interpret data, and to integrate data into management of the watershed; and
- creating a publicly accessible database management system

Long-Term Monitoring and Assessment Plan for the San Francisquito Creek Watershed

A conceptual framework for integrating information needs into a cost-effective and predictable program that will guide decision-making on San Francisquito Creek watershed and floodplain issues and evaluate the success of those decisions

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Acknowledgements

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San Francisquito Creek Watershed Long-Term Monitoring and Assessment Plan

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1.0 Introduction

This document describes a conceptual framework for a Long-Term Monitoring and Assessment Plan (LTMAP) for the San Francisquito Creek watershed. A work group convened by the Steering Committee of the San Francisquito Watershed Council (formerly known as the Coordinated Resource Management and Planning [CRMP] process) developed this Plan. The LTMAP identifies and prioritizes information needs, and lays out a framework for coordinating monitoring and assessment activities within the watershed.

There are several benefits to using the Long-Term Monitoring and Assessment Plan for coordinating monitoring and assessment activities within the watershed including:

- reducing costs to participating agencies and organizations through economies of scale
- leveraging expenditures to conduct studies not normally affordable on an agency-by-agency basis
- increasing the likelihood of receiving matching funds from state and federal agencies as well as private foundations
- ensuring the usefulness and timeliness of expenditures and study results by building on and linking to related efforts

1.1 San Francisquito Creek Watershed

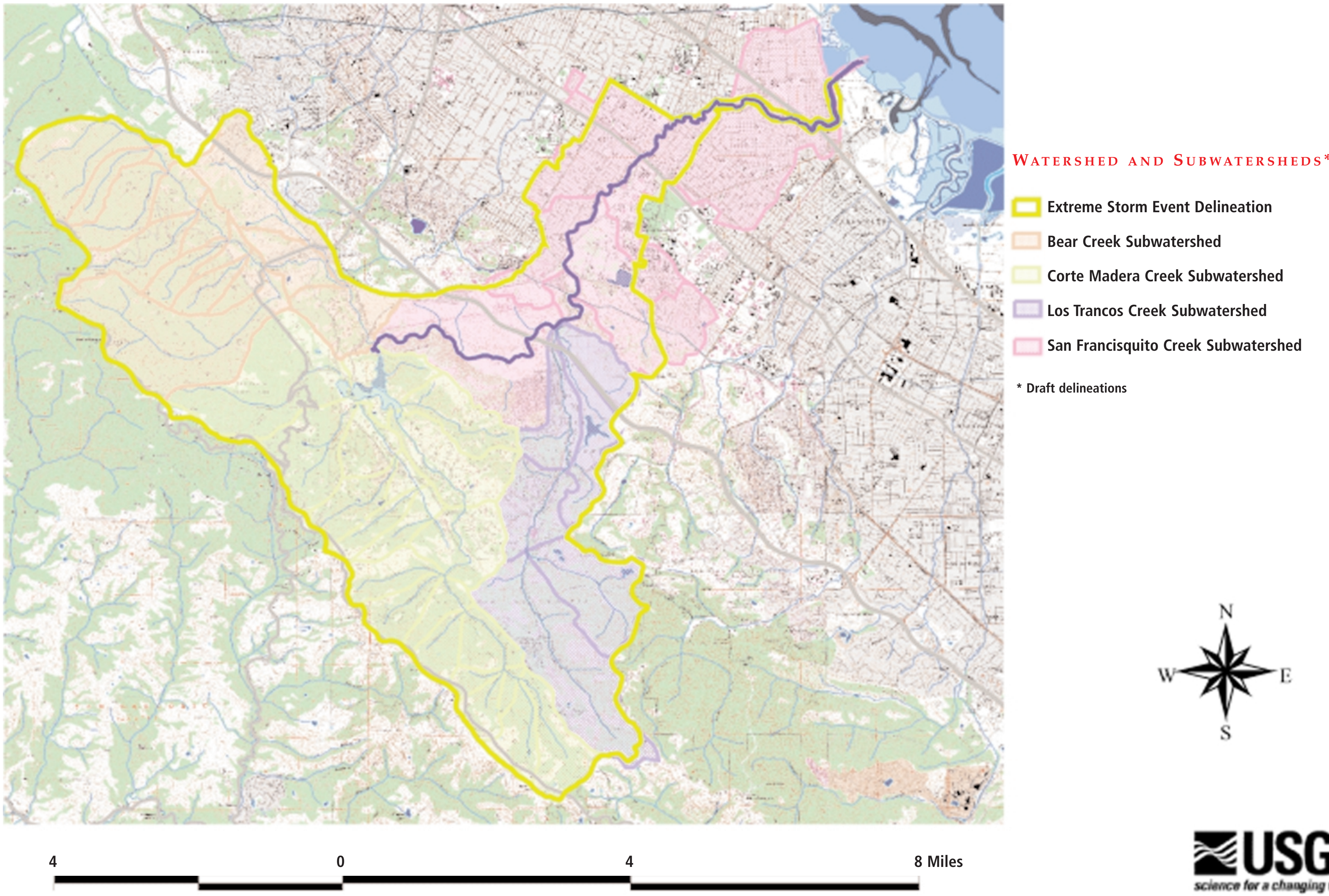
The San Francisquito Watershed is located on the San Francisco Peninsula, and includes the northwestern-most portion of Santa Clara County and the southeastern-most portion of San Mateo County (see Figure 1). In its downstream reaches, San Francisquito Creek and its Los Trancos Creek tributary form the boundary between the two counties. The watershed encompasses an area of approximately 45 square miles, extending from the ridge of the Santa Cruz Mountains to San Francisco Bay. This area includes a wide diversity of urbanized, rural, and natural habitats.

For the purposes of this document, the San Francisquito watershed is defined as all lands draining to San Francisquito Creek and its tributaries including natural flows and areas served by storm drains. The floodplain is defined as the 100-year flood zone.

Citizens and public agencies concerned with the health of San Francisquito Creek are currently addressing a number of issues. Two examples serve to exemplify these issues, and illustrate the importance of developing a coordinated approach to long-term monitoring and assessment in the San Francisquito Creek watershed: impacts upon salmonid habitat and migration, and local flooding.

Many of the tributary streams flowing into San Francisco Bay historically supported abundant steelhead trout populations. While many of these streams no longer sustain viable steelhead populations, related native rainbow trout populations continue to persist in many of the headwater streams. The San Francisquito Creek watershed continues to support an anadromous steelhead population as well as native rainbow trout in headwater streams above human-made barriers to steelhead migration. The steelhead trout of San Francisco Bay watersheds are now federally listed as a threatened species. At the request of the California Department of Fish & Game, impairment to freshwater steelhead habitat and other aquatic resources due to sedimentation prompted the Regional Water Quality Control Board to include San Francisquito Creek on the 1998 Clean Water Act Section 303(d) list of impaired waterbodies (USEPA, 1999).

Figure 1. San Francisquito Watershed



USGS
science for a changing world

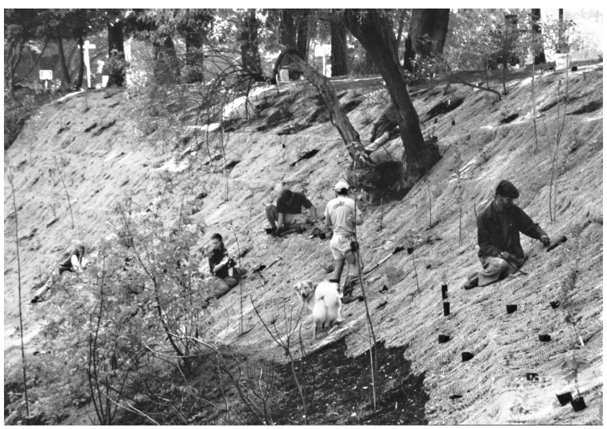
1.1 San Francisquito Creek Watershed

(continued from page 1)

In spring, 1998, runoff from a series of heavy winter rains resulted in flooding in the lower San Francisquito Creek watershed, causing $28 million dollars in property damage (US Army COE and SCVWD, 1999). The unprecedented magnitude of the flood-related damages and the potential threat to public health and safety has sparked investigations into the causes and mechanisms of flooding in this watershed and contributing factors, and efforts to provide earlier warning of potential flood conditions.

As with many other local watershed issues, these issues are complex and influenced by a variety of factors, including physical, hydrological, chemical, biological and social characteristics and processes within the watershed. This LTMAP seeks to:

- identify the key questions facing stewards of the San Francisquito Creek watershed,
- develop objectives for a comprehensive, long-term monitoring and assessment program that will address those key questions, and
- describe the elements of a program that will provide the information needed to satisfy the objectives and allow for informed management decision-making within the watershed.



Volunteers replanting creek bank with native vegetation.

Figure 2 illustrates the relationship between these activities and the watershed management efforts / regulatory drivers that are affecting the watershed. This type of relationship is referred to as an adaptive management approach. An adaptive management approach uses public concerns and issues and sound science to generate the information necessary to make decisions and to evaluate the implications and success of those decisions. Each of the elements of the adaptive management approach are introduced and described below in more detail.

1.2 Watershed Management—Overview

Environmental management is evolving from a system based on "divide and conquer" to a more comprehensive approach called watershed management. The divide and conquer approach was characterized by dividing the environment into understandable and manageable pieces (e.g., air, water, biological species) and authorizing separate regulations (e.g., Clean Air Act, Clean Water Act, Endangered Species Act) and jurisdictions (e.g., air boards, water boards, resource agencies) to deal with each piece. Watershed management is an attempt to understand the environment as a whole system by putting the pieces back together and then managing each piece while keeping the "big picture" in mind.

Environmental management is evolving from a system based on "divide and conquer" to a more comprehensive approach called watershed management.

1.2.1 Local and Regional Watershed Management

The interest in adopting a watershed management approach has manifested itself in several ways in the San Francisquito Creek watershed over the last several years. The following efforts are summarized in Appendix A, along with impending deadlines and a description of some of the benefits to local jurisdictions of monitoring and assessment.

- San Francisquito Watershed Council
- Joint Powers Authority (JPA)
- Santa Clara Basin Watershed Management Initiative (SCBWMI)
- Regional Monitoring and Assessment Strategy (RMAS)
- Integrated-science and Community-based Land Use Decision making (INCLUDE)

1.2.2 Regulatory Drivers

The following sets of regulations affect management of San Francisquito Creek, as described in Appendix A. These regulations specify various requirements affecting local jurisdictions and provide motivation for local watershed monitoring and assessment activities.

- Clean Water Act (CWA)
- Basin Plan
- Stream Protection Policy & Strategy (SPP&S)
- Storm Water Permits
- Endangered Species Act (ESA)

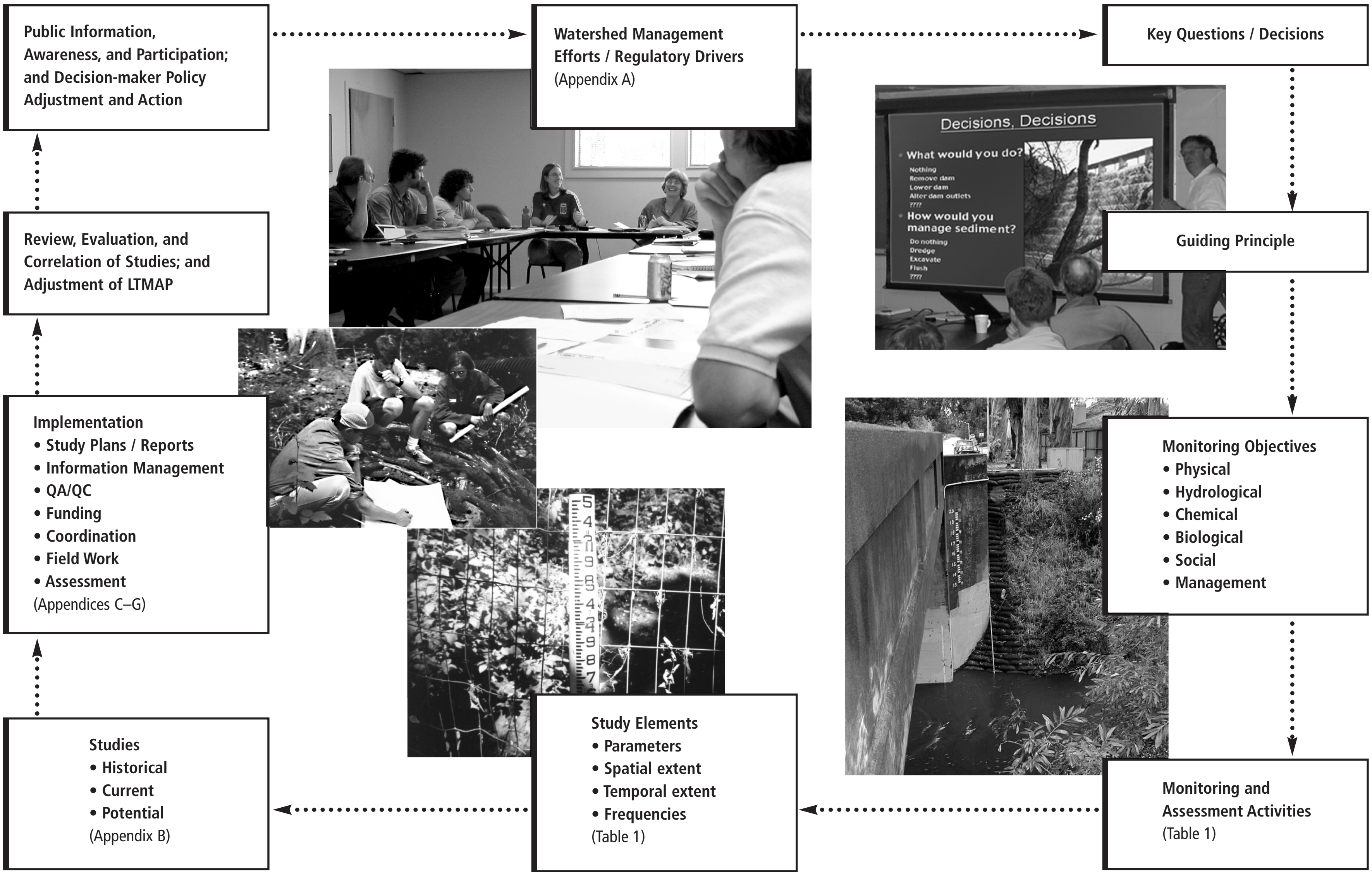
1.2.3 Monitoring and Assessment

One of the basic tools of watershed management is watershed assessment. In the discussion that follows, "monitoring" is loosely defined as any data collection effort, and "assessment" is loosely defined as the process of interpreting and evaluating the monitoring data to provide informed input for management decision-making. Watershed assessments require diverse types of monitoring data, including inventories of basic watershed characteristics like geographic features, population demographics, creek habitat, and water quality. Assessments are vital because they provide the information necessary to make decisions and to evaluate the implications and success of those decisions. As a result, assessment of the ecological health of watersheds is receiving increasing interest from regulatory agencies such as the Regional Water Quality Control Board (Regional Board) and Department of Fish & Game, and generating needs for better and more current monitoring data. As these agencies adopt a watershed management approach to managing their pieces of the environment, the role of watershed assessment information will become increasingly important.

Watershed assessments require diverse types of monitoring data, including inventories of basic watershed characteristics like geographic features, population demographics, creek habitat, and water quality.

Figure 2. **LTMAP – Adaptive Management Approach**

An adaptive management approach is a feedback system that can start at any point in the closed-loop. The approach uses public concerns and issues, and sound science to generate the information necessary to make decisions and to evaluate the implications and success of those decisions.



2.0 Long-Term Monitoring and Assessment Plan

To date, the vast majority of the efforts to monitor and assess the San Francisquito Creek watershed and floodplain have been brief and lacking in inter-project coordination. As a result, although we intuitively know that the watershed and its floodplain function as a complex system of integrated natural processes, habitats, and plant and animal species, the depth and breadth of our current level of understanding, and hence our ability to make decisions, is severely hampered by a lack of good information. Yet on a regular basis decisions must be made to comply with applicable regulations, foster a diverse and healthy watershed, protect public health and safety, and maintain quality of life. A coordinated, long-term monitoring and assessment plan will allow local agencies to integrate their information needs into a cost-effective and predictable program that will guide decision-making on San Francisquito Creek watershed and floodplain issues and evaluate the success of those decisions.

The LTMAP is intended to provide a focus for coordination of the diverse efforts of the various groups and agencies conducting studies in the San Francisquito Creek watershed. The Plan also provides a conceptual framework for the process of identifying the pressing questions in the watershed, and defining overall objectives for monitoring and assessment activities that address those questions.

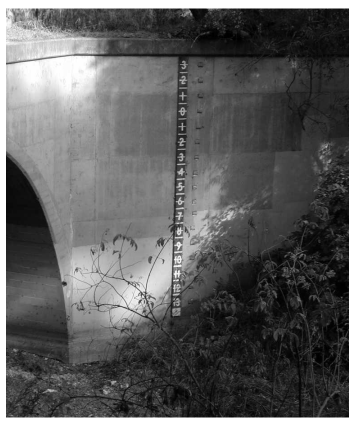
The LTMAP is intended primarily for monitoring and assessment of current conditions (i.e., baseline), analyses of trends, and evaluation of watershed management options. However, some significant issues, such as the effects of projected land use changes and flood prevention/management options, would clearly benefit from a predictive use of data (e.g., via modeling) to evaluate the likely outcomes of various management decisions. Although the plan does not focus on predictive uses of data, such issues can certainly be accommodated by the plan's structure.

A coordinated, long-term monitoring and assessment plan will allow local agencies to integrate their information needs into a cost-effective and predictable program that will guide decision-making on San Francisquito Creek watershed and floodplain issues and evaluate the success of those decisions.

2.1 Key Questions

Following consideration of the various ongoing watershed management initiatives, the regulatory drivers, and other issues motivating interest in the San Francisquito Creek watershed, the LTMAP work group identified the following key questions pertaining to informational needs for effective watershed management:

- What are the physical conditions throughout the watershed and what are critical issues/areas of concern? What are the sources and sinks for sediment within the creek system, and what are the effects of sediment processes on aquatic habitat and flooding potential?
- What are the effects of land use changes on creek chemistry, hydrology, physical structure and habitat?
- What are the hydrological characteristics of the creek system at key locations (low flow conditions, flood flows/frequency, surface: subsurface interchange, discharges to the creek such as urban runoff, withdrawals/diversions, and physical structures such as gabions, concrete retaining walls), and how do these factors affect aquatic habitat and flooding potential?
- What are the current levels of key water quality constituents (including sediment and diazinon) at key locations within the watershed and how do they change in response to weather conditions (incl. antecedent conditions), seasonally, and over the long term?



A level marker for the San Francisquito Creek at Pope and Chaucer.

- What are the effects on aquatic life of creek water chemistry, including measured concentrations of the 303(d)-listed parameters (diazinon, sediment) and other known constituents of concern?
- What are the effects on aquatic life of current creek sediment chemistry, including measured levels of diazinon and other known constituents of concern?
- What is the biological condition of the creek/watershed? What is the quality of the riparian and aquatic habitat, and where and how does it vary?
- What is known about species populations and community structure in the watershed, especially with respect to special status species? What are the critical issues/areas of concern? Are creek water or sediments toxic to test species?
- Are the designated beneficial uses of the water bodies as listed in the Basin Plan supported as determined by the Regional Board? Are all appropriate beneficial uses designated?
- Are there potential human health impacts to recreational users of the creek?
- What are the social concerns pertaining to creek use and enjoyment by the human population? Where do human activities (including littering) have negative effects on the watershed? How do the sociological characteristics of the resident population affect communication about aquatic life and beneficial uses and their protection?
- What are the community uses/values of the watershed, and what are the critical issues/areas of concern?
- For any given management decision or action, what are the options and how are the outcomes projected and evaluated?

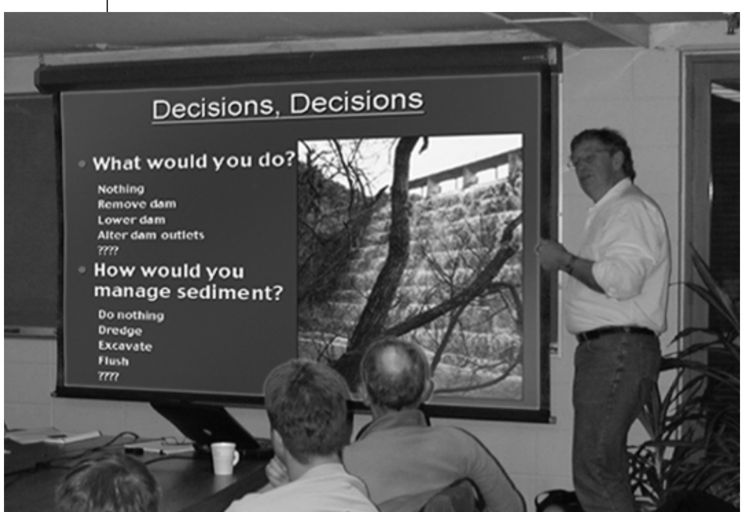
These key questions were used by the work group to formulate the overall objectives of the LTMAP, as discussed below.

2.2 Guiding Principle and Objectives

As stated earlier, assessments are vital because they provide the information necessary to make decisions and to evaluate the implications and success of those decisions. Given the regulatory, management, technical, and financial implications of watershed assessments, it is important to formally state why assessments should be done, by establishing a Guiding Principle and Objectives. The following guiding principle and objectives were developed by the Long-Term Monitoring and Assessment work group convened by the San Francisquito Watershed Council.

2.2.1 Guiding Principle

Provide information to the public and decision-makers by assessing on an ongoing basis the beneficial uses and stream functions of the San Francisquito Creek watershed and floodplain, and evaluating whether the uses and functions are appropriate and supported.



Presenting information regarding Searsville Dam.

2.2.2 Objectives

Based on the work group's identification of the driving issues in the San Francisquito Creek watershed and floodplain (Appendix A), and discussion of the key watershed management questions and key policy decisions (listed above) that face local agencies responsible for the health of the creek, the LTMAP work group has developed the following list of objectives for the monitoring and assessment program (use of the word "creek" in the objectives should be interpreted to mean all the waterbodies in the watershed). The objectives are grouped by categorical type, according to whether they address issues associated with physical, hydrological, chemical, biological or social characteristics or processes.

A. Physical

1. Monitor and assess the condition of the physical habitat and the processes (artificial/natural) that affect this habitat within the watershed as they relate to the health and beneficial uses of the creek. These factors include: erosion, sediment budget, bank stability, barriers, vegetation, and restoration efforts.
2. Monitor and assess existing and projected land use impacts on creek health including: land use types, surface drainage systems, and impervious surfaces.

B. Hydrological

1. Flooding - Monitor and assess the hydrologic characteristics of the watershed and its floodplain, including: watershed and flood zone boundaries (artificial/natural), hydrologic cycle (rainfall, interception, infiltration, and runoff), water budget, and flood history and potential.
2. Habitat - Monitor and assess the flow regimes of the watershed as they relate to habitat needs including: low flow and flood flow conditions, surface and subsurface flows, discharges, water withdrawals, and water rights.

2.2.2 Objectives

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C. Chemical

1. Monitor and assess the spatial and temporal distribution, sources, and impacts of known pollutants within San Francisquito Creek and its tributaries, as required by the Clean Water Act (CWA) section 303 (d) listings and TMDLs.
2. Identify and assess the distribution, sources, and impacts of other chemical constituents and related parameters that may support or impact the health of San Francisquito Creek and its tributaries, or affect the impact of San Francisquito Creek discharges on the South Bay.

D. Biological

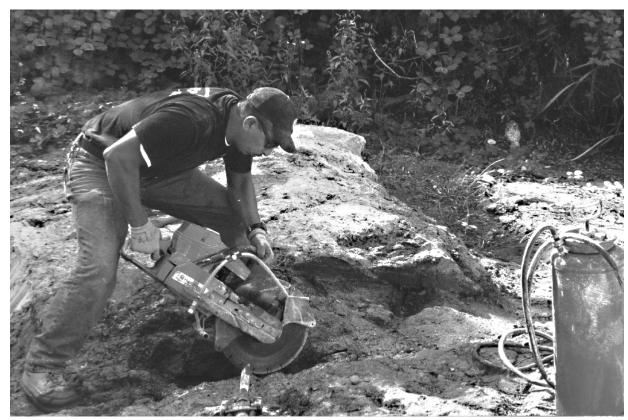
1. Monitor and assess the condition of the biological habitat and the processes (artificial/natural) that affect this habitat within the watershed as they relate to the health and beneficial uses of the creek.
2. Monitor and assess biodiversity within the creek and riparian corridor and related wetlands and other waterbodies, including: population structures, genetic diversity, trends in special status species as well as other species of ecological or community significance, including invasive species.
3. Monitor and assess the toxicity of water and sediment and identify any toxicants.
4. Monitor and assess water quality parameters (e.g., coliform, pathogens) indicative of potential public health impacts.

E. Social

1. Monitor and assess community interests and concerns about the riparian corridor and related wetlands and other waterbodies, including: aesthetics, recreation, natural resources, property and water rights, and educational opportunities.
2. Monitor and assess societal aspects and resources of the watershed as they affect the stewardship of the creek, including: demographics, population density, income, home ownership, libraries, interpretive sites, and access points.
3. Monitor and assess the impacts of human activities (litter, encampments, recreation) in the creek and riparian corridor.

F. Management

1. Implement the Long-Term Monitoring and Assessment Plan using an adaptive management approach to keep it current. An adaptive management approach uses public concerns and issues and sound science to generate the information necessary to make decisions and to evaluate the implications and success of those decisions.



Cutting a notch into a barrier to steelhead migration.

2.3 Elements of the Monitoring and Assessment Plan

The San Francisquito Creek Long-Term Monitoring and Assessment Plan is organized as a set of program elements corresponding to the physical, hydrological, chemical, biological and social objectives described above. These elements provide a conceptual structure for a long-term monitoring and assessment program that is designed to comprehensively address the wide-ranging set of management and policy questions previously identified for San Francisquito Creek. This framework for the LTMAP is meant to be flexible and adaptable, to meet changing information needs within the San Francisquito Creek watershed.

A fish survey crew at work in the field.

Table 1 presents the framework for the LTMAP elements, including specific monitoring and assessment activities to address each objective. For each activity the following descriptive items are presented:

- parameters to measure,
- the spatial and temporal extent of monitoring,
- monitoring locations and frequency,
- existing (current or historical) monitoring projects that relate to the objective,
- potential projects to fill data gaps, and
- related watershed management questions.

Appendix B presents basic information about current, potential, and selected historical studies.

Researchers conducting each of these plan elements need to consider the intentions, plans, and outputs of other elements. For example, results of hydrologic assessments targeted at “critical life stages” of sensitive species clearly need to draw on results of biological assessments about species present; and the biological assessments should explicitly identify critical life stages of sensitive species, including the annual timing of those stages and the needs (hydrologic, stream substrate, water temperature, etc.) of those species at those stages. Studies should explicitly include a task to identify the informational needs of other LTMAP elements, and analyses to address those needs.

2.3.1 Physical

The physical characteristics of the watershed affect its hydrological, chemical and biological characteristics, which in turn affect the creek's beneficial uses, including public enjoyment of the creek's resources.

One of the key issues in the San Francisquito Creek watershed involves the impacts of sediment on aquatic habitat. The widespread decline of the historical anadromous fish runs throughout the San Francisco Bay area is considered to be in some measure due to the effects of sedimentation in creeks. Sediment deposits that create physical barriers to fish migration (sand bars), or that "silt in" fish spawning or rearing pools are thought to contribute significantly to this problem in the San Francisquito Creek watershed, and the creek is listed on the CWA section 303(d) list of impaired waters due to sedimentation. One of the first steps in developing a TMDL will be to develop a "problem statement" which may include confirming the impairment listing through monitoring. Monitoring is also needed to identify physical impediments to fish migration and spawning, and to provide information related to sediment sources and transport that can be used in developing a sediment TMDL.

The effect of sediment build-up on local flooding potential is another key issue in the watershed. For this reason, monitoring is also needed to provide information on sediment supply (including bank stability and erosion) and deposition (especially pertaining to reductions in flood storage and conveyance capacity).

Measuring the height of a fish barrier.

To address these issues, the Physical 1 LTMAP element involves monitoring and assessment of the watershed's physical habitat, with activities specified for deriving a sediment budget, inventorying the physical characteristics of the watershed, and assessing the affects of those physical characteristics on biotic habitat.

The physical nature of the watershed is also characterized by its predominant land use patterns. Changes in land use patterns in turn may impact creek habitat, sediment transport, flow regimes, and flooding potential. The Physical 2 element addresses the land use characteristics of the watershed and their affects on flow quality and quantity. Activities are planned to compile land use and drainage data, assess the impacts of land use changes, and evaluate the impacts of land use plans.

2.3.2 Hydrological

A USGS stream gauging station.

Hydrological information is necessary for accurate projections of flooding potential, as well as evaluations of the effects of critical in-stream flows on aquatic habitat.

Knowledge of the basic hydrology of the watershed is fundamental to understanding the watershed's physical, chemical, and biological processes. In particular, hydrological information is necessary for accurate projections of flooding potential, as well as evaluations of the effects of critical in-stream flows on aquatic habitat.

The Hydrological 1 element includes activities related to measuring hydrological parameters such as rainfall and stream flows; deriving hydrological characteristics such as rainfall/runoff relationships, flood flows and frequencies; delineating sub-watershed boundaries and flood zones; and predicting flooding potential.

The Hydrological 2 element involves compiling information on critical flows for aquatic habitat, and assessing impacts of low flows on sensitive life stages of key species.

2.3.3 Chemical

Within the past several years there has been extensive documentation of aquatic toxicity in surface waters and urban runoff due to the presence of organophosphorous pesticides. This has caused the listing of numerous urban creeks throughout California on the state's CWA section 303(d) list of impaired waters, including San Francisquito Creek (due to diazinon). This listing has in turn triggered the requirement for developing a TMDL for diazinon. Information is need on the spatial and temporal distribution of diazinon within the creek (including both water column and sediments), and the key sources of diazinon loadings to the creek, as well as the potential impacts of the measured diazinon levels on aquatic life.

Other chemical constituents are of concern within the San Francisquito Creek watershed, because of potential or suspected impacts on aquatic life within the creek, or due to their listing as causes of impairment within San Francisco Bay on the CWA section 303(d) list. Information is needed on the distribution and sources of these constituents within the San Francisquito Creek watershed, and their impacts upon aquatic life within the creek and bay.

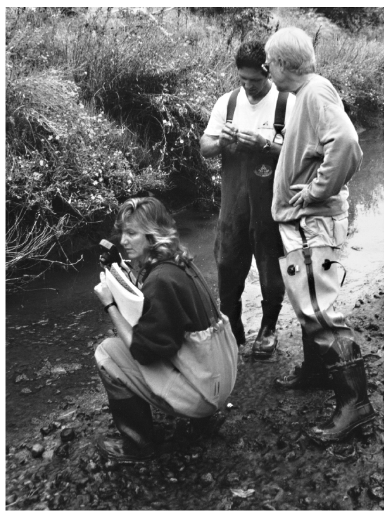
The Chemical 1 element of the LTMAP is designed to provide the information needed on diazinon levels within the creek system through water and sediment quality monitoring. This information will be useful in deriving a TMDL for diazinon and in assessments of the potential for aquatic life impacts. The Chemical 2 element includes activities designed to provide information on the distribution and sources of other constituents of concern in surface waters and sediments, and to assess the potential impacts of the observed contaminant levels on aquatic life within the creek and bay.

Water quality monitoring station – San Francisquito Creek at Newell Road.

2.3.4 Biological

Much of the motivation for implementing a long-term monitoring and assessment program involves concerns over the health and welfare of aquatic life within the San Francisquito Creek watershed. While anadromous fish serve as the most common focal point for these concerns, biological issues related to habitat quality for other species, biodiversity, and human health impacts are also of interest. Four biological elements have been set up within the LTMAP, to address monitoring and assessment activities related to:

1) biological habitat quality (for fish and other species),
2) biodiversity (population size and structure for state and federally listed species and other species of concern, plus invasive/nuisance species),
3) aquatic toxicity testing (for water and sediment), and
4) human health impacts (particularly with respect to water-borne pathogens).



Biologists surveying mitten crab burrows.

2.3.5 Social

An understanding of the social aspects of the creek ecosystem is essential for effective management of the watershed...

San Francisquito Creek is a complex natural resource that is both available for the use and enjoyment of the human community, and is also impacted by human activity. An understanding of the social aspects of the creek ecosystem is essential for effective management of the watershed, so as to achieve the full range of beneficial uses while also striving to protect the resource from unwanted impacts.

The LTMAP includes three social elements, covering activities in the areas of:

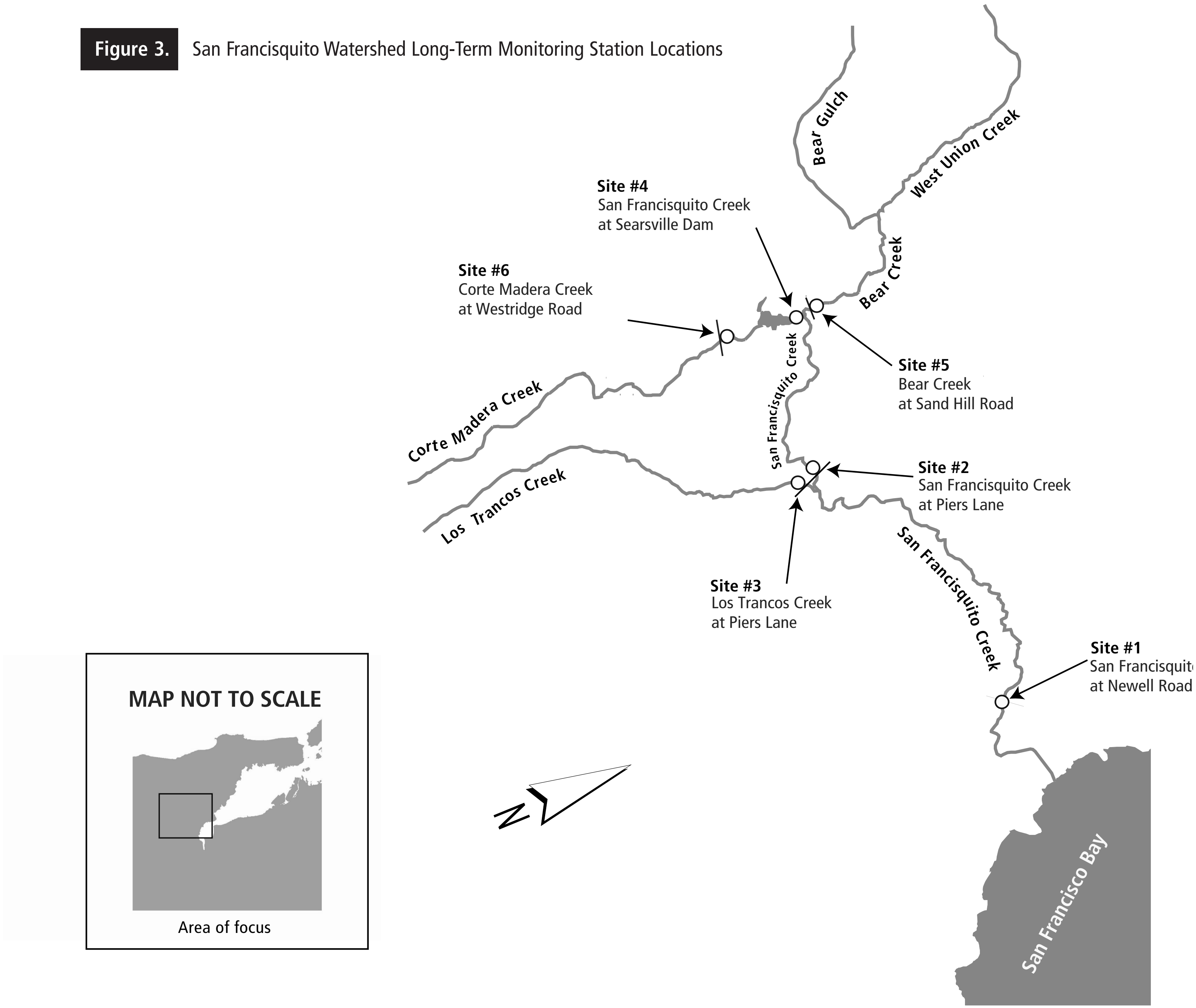
1) community values as they relate to the watershed/creek ecosystem,
2) the social characteristics of the watershed's human community, and
3) the nature and extent of human impacts upon the watershed's natural resources.

2.3.6 Long-Term Monitoring Stations

In addition to the Plan elements, for some measurements such as monitoring chemical parameters, it's important to establish sites from which to conduct monitoring on a long-term basis. Monitoring at the same site time-after-time removes variability in data collection—making assessments of status and trends over time more conclusive. In addition, sites can be selected that help define subwatersheds separate from each other. Based on a review of sites used currently or in the recent past, the following six sites were selected to represent key watershed segments as long-term monitoring locations (from bottom to top of the watershed) (Figure 3):

1. San Francisquito Creek @ Newell Bridge - This site is the most accessible point above the tidal influence of the Bay and has been used by the City of Palo Alto for creek monitoring for a number of years. This station would represent the overall watershed prior to discharge to the bay, and would define creek quality downstream of the "urban" portion of the watershed.
2. San Francisquito Creek @ Piers Lane - This site, just upstream of the confluence with Los Trancos Creek, has been used in several studies and would represent the San Francisquito Creek watershed upstream of this point as separate from the Los Trancos Creek watershed. Together with the Los Trancos Creek site, this site will help define creek quality upstream of the urbanized area.
3. Los Trancos Creek @ Piers Lane - This site, just upstream of the confluence with San Francisquito Creek, has also been used in several studies and would represent the Los Trancos Creek watershed. Together with the San Francisquito Creek at Piers Lane site, this site will help define creek quality upstream of the urbanized area.
4. San Francisquito Creek @ Searsville Dam - This site, just downstream of the dam discharge, has also been used in several studies and would represent the Searsville Lake watershed.
5. Bear Creek @ Sand Hill Road - This site, just upstream of the confluence with San Francisquito Creek, has also been used in several studies and would represent the Bear Creek watershed.
6. Corte Madera Creek @ Westridge Road - This site has also been used in several studies and would represent the Corte Madera watershed.

Figure 3. San Francisquito Watershed Long-Term Monitoring Station Locations



2.3.6 Long-Term Monitoring Stations

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The City of Palo Alto installed automated water quality monitoring stations at the first three sites (San Francisquito Creek @ Newell and Piers Lane and Los Trancos Creek @ Piers Lane) in the spring of 2001. The City will operate the Newell station while Stanford University operates the two Piers Lane stations. This long-term water quality monitoring effort is designated as study "C29" (C = current)(see 2.3.7 Nomenclature). In addition, Stanford University plans to install stations on San Francisquito Creek @ Searsville (station #4 above) and Los Trancos Creek @ Felt Lake diversion. The San Francisquito Watershed Council is working on establishing a station on Bear Creek @ Sand Hill Road (station #5 above).

In addition to the six land use/geographically-based sites, there may be a need for relatively undisturbed reference sites in the upper watersheds (i.e., Bear Creek, Searsville Lake, and Los Trancos Creek). The following were tentatively selected as candidate locations:

- Bear Gulch Dam, and
- Location(s) to be determined in Corte Madera watershed and/or Los Trancos watershed (depending on how different the habitats of these watersheds are from each other)

In addition, it may be important to monitor key storm drain outfalls, particularly if they contribute significant flow to the creek or are important to identifying sources of potential pollutants.

Monitoring station at Los Trancos at Piers Lane.

2.3.7 Nomenclature

To facilitate identifying individual studies, the following alphanumeric nomenclature is used:

C# = Current study (e.g., C29 – Long-term Water Quality Monitoring)

H# = Historical study (e.g., H22 – Allardt and Grunsky's 1888 inspection)

P# = Potential study (e.g., P15 – Long-term monitoring of upper watersheds)

To facilitate tracking studies when their status changes from, for example, a current study to a historical study (i.e., the study is completed), present and past designations are shown:

H30 = C8 Adult Steelhead Passage in the Bear Creek Watershed

Appendix B presents basic information about current, potential, and selected historical studies.

2.4 Long-Term Implementation

Implementing the Long-Term Monitoring and Assessment Plan will require that involved organizations set up a well-defined and coordinated management system that covers the following areas.

San Francisquito Watershed Council discussing creek issues.

2.4.1 Adaptive Management

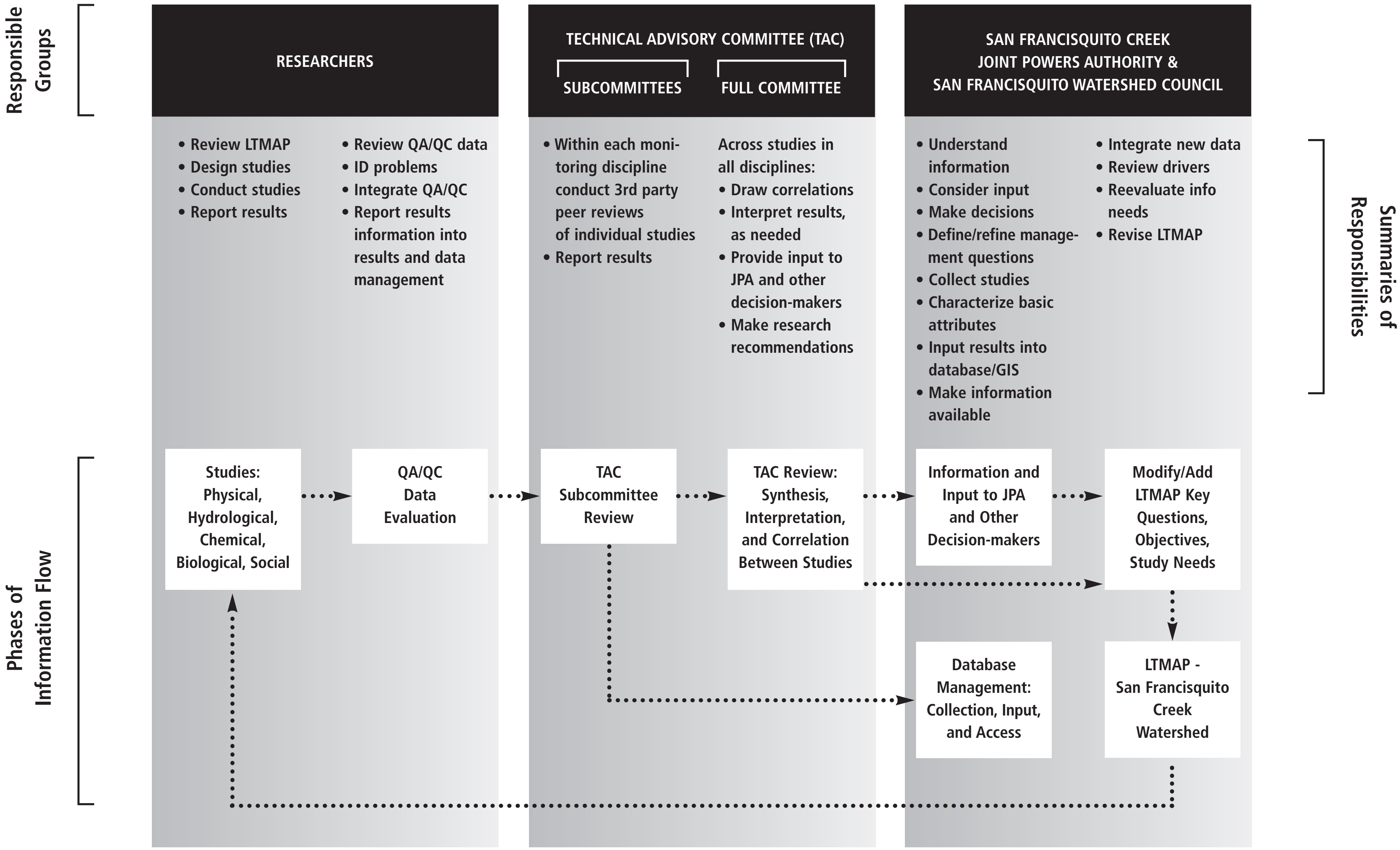
Figure 4 illustrates how monitoring and assessment information will be managed within the adaptive management approach illustrated in Figure 2. In Figure 4, scientific monitoring and assessment information flows from research studies to decision-making and back again for each of the five monitoring objectives or disciplines—physical, hydrological, chemical, biological, and social. This flow of scientific information is a subset of a more comprehensive adaptive management approach, which also includes public participation and implementation of decisions (e.g., policies, programs, projects, and procedures).

Study Plan / Report Integration

As discussed earlier, a coordinated, long-term monitoring and assessment plan will allow local agencies to integrate their information needs into a cost-effective and predictable program, and to leverage the result of individual studies. The level of integration depends on the extent to which individual studies and the overall plan complement each other. Appendix C provides brief guidelines on basic information requested in study plans and reports that will link individual studies to the LTMAP. Researchers are encouraged to consider the questions posed in Appendix C and to provide the answers in both study plans and reports. By using Table 1, which presents the LTMAP elements, including specific monitoring and assessment activities to address each objective, researchers can identify data needs (i.e., potential studies) and design studies to address them.

Figure 4. **Information Management Process**

This figure illustrates how scientific monitoring and assessment information will flow from research studies to decision-making and back again for each of the five monitoring objectives/disciplines. This flow of scientific information is a subset of a more comprehensive adaptive management approach, which also includes public participation and implementation of decisions (e.g., policies, programs, projects, and procedures). Groups responsible for various phases of information flow and use are shown along with summaries of their responsibilities.



2.4.1 Adaptive Management

(continued from page 18)

Data Needs

For each LTMAP element, Table 1 lists preferred frequencies for data collection based on the current understanding of available data and stakeholder interests. Over time, estimates of the amount of data needed to make decisions (i.e., to be statistically representative) and projected data thresholds/ benchmarks for actions (i.e., what defines a problem or a success, or indicates a need for specific action) will need to be established as data are gathered and analyzed. This process will help ensure that, on the one hand, decisions are made and actions taken using sufficient data, while on the other hand, data will not be collected that will not be used.

Researchers must identify data acquisition needs pertaining to each project-specific study objective, taking into consideration the project resources and constraints, known or projected data characteristics (range, temporal and spatial variability), and planned data analysis tools. Power analysis is a statistical tool that is often used to project the number of discrete data points that would be required to provide definitive answers to specific study questions within certain levels of statistical confidence (Taylor, 1990).

Consultants reviewing plans for constructing a fish ladder on Los Trancos Creek.

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Quality Assurance / Quality Control

A thorough and effective QA/QC program is an essential aspect of any monitoring project. While the specific QA/QC methods applied vary with the type of monitoring project (e.g., sediment quality, water quality, habitat evaluation) and the specific nature of the project activities, certain key activities should be included in the development of the QA/QC program for each project. For watershed monitoring projects, these activities should include:

- Use of a "systematic planning process" to define specific project objectives, determine key study parameters, identify data acquisition methods (including QA/QC activities), and develop performance and acceptance criteria for the data. The performance and acceptance criteria are tailored to the planned data acquisition methods, and typically include the development of data quality objectives (DQOs) and preparation of a data quality evaluation plan (DQEP) for the project (USEPA, 2000).
- All project methods should be specified in a monitoring plan, along with appropriate information regarding equipment, personnel, logistics and safety considerations. An example is provided as Appendix D – Sampling and Analysis Plan for Monitoring Surface Water Quality at Long-term Stations. For projects that include funding from USEPA, a Quality Assurance Project Plan (QAPP) is typically required. Although the QAPP format is not ideal for such projects, it essentially leads the preparer through a systematic planning process and results in the equivalent of a monitoring plan (USEPA, 1998).
- Peer review of the project-specific monitoring plan to provide assurance that the study design is sound, the planned study methods are appropriate, and the planned data acquisition will provide information to effectively satisfy project objectives.
- Coordination of each project with other projects in the watershed, to ensure consistency and compatibility of approach and to foster interdisciplinary transfer of data and resources.
- Coordination of QA/QC protocols with regional standards or programs.
- Review of the project data (including QA/QC data) to determine where project-specific objectives are or are not being met and to identify any notable QA/QC problems, and modification or revision of study methods as appropriate to provide corrective action where needed.
- Integration of QA/QC information into the data management system so that this information is readily available and useable in any data analysis and interpretation work.

2.4.1 Adaptive Management

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Review, Synthesis, and Interpretation

The function of synthesizing and interpreting data from studies conducted in the watershed is critical to the data being used and to integrating the LTMAP into management of the watershed. To perform this function, the LTMAP includes a technical advisory committee (TAC). The major tasks of the TAC will be to:

1) draw correlations between studies and interpret the results, as needed,
2) provide input to the Joint Powers Authority and other decision-makers, and
3) make research recommendations.

To facilitate the work of the TAC, the LTMAP also includes TAC subcommittees—one for each of the five types of objectives. Each subcommittee is comprised of 2-3 individuals with some individuals on more than one subcommittee. Members of the subcommittees are also members of the overall TAC. Whereas the TAC has technical specialists, technical generalists, and staff from the JPA, agencies, and San Francisquito Watershed Council on it, the subcommittee members are technical specialists and generalists in each of the respective monitoring objectives: physical, hydrological, chemical, biological, and social. The role of the TAC subcommittees is to conduct third party peer reviews of studies within their disciplines and to report the results of their reviews to watershed stakeholders.

Database Management

Data generated by the studies conducted as part of the Long-Term Monitoring and Assessment Plan must be well managed to be useful. Data should be:

1) gathered and stored using the best practically available technologies (methods, equipment, software);
2) integrated geographically across the watershed and coordinated with other watersheds;
3) assessed and integrated across multiple monitoring objectives; and
4) communicated in a timely, understandable, and accessible way. The San Francisquito Watershed Council will work with the involved organizations to develop a database management system that meets these criteria (Appendix E).

Data Use and Decision-Making

The Long-Term Monitoring and Assessment Plan is predicated on the concept that a coordinated, long-term monitoring and assessment approach will allow local agencies to integrate their information needs into a cost-effective and predictable program that will guide decision-making on San Francisquito Creek watershed and floodplain issues and evaluate the success of those decisions. Inherent in this concept is that decision-makers will accept and understand the information provided by researchers, and that they will use the data to make and evaluate decisions. Decision-makers will also generate or revise management questions that require monitoring and assessment information. In turn, these decisions or management questions drive the adaptive management approach through another cycle of studies, interpretations, and recommendations.

Coordination and Updates

The San Francisquito Watershed Council will continue to track the various related activities of local and regional agencies within the San Francisquito Creek watershed and floodplain, and promote communication and coordination among related monitoring and assessment efforts and watershed management activities. The San Francisquito Watershed Council will periodically convene the LTMAP work group to review, evaluate, and revise or add to the LTMAP as necessary so that it remains a timely and useful document.

2.4.2 Funding

The Plan will define what to measure and why, and the various affected jurisdictions and other watershed stakeholders will need to arrive at the means for funding and implementing the Plan, or selected elements. Some of the elements described in the Plan are likely to involve ongoing activities funded and/or implemented by local or regional entities. Others may require development of funding mechanisms prior to implementation. These include:

- Studies
- TAC and TAC Subcommittee
- Database management

The desired end result is that the available monies will be focused on developing and assessing the most useful information (i.e., information that is linked to watershed decision-making and therefore will provide the basis for better or different decisions than would be possible without the information).

Some of the elements described in the Plan are likely to involve ongoing activities funded and/or implemented by local or regional entities. Others may require development of funding mechanisms prior to implementation.

2.5 Implementation in Fiscal Year 2001/02

Implementation of the Long-Term Monitoring and Assessment Plan during fiscal year 2001/02 includes a variety of planned and ongoing projects to address many of the overall LTMAP objectives. Appendix F presents a matrix of current Long-Term Monitoring and Assessment studies for fiscal year 2001/02. For each overall objective, the matrix shows monitoring and assessment activities currently being conducted or planned for the San Francisquito Creek watershed in 2001/02. Descriptions of most of the current studies can be found in the SCBWMI's metadata database or the Inventory of Santa Clara Basin Stream Studies (SCBWMI, 2001). For studies not listed in the Stream Studies Inventory, Appendix G presents brief project descriptions as they relate to the key questions, objectives, and assessment needs in the LTMAP. Appendix H is a brief listing of accomplishments during fiscal year 2000/2001.

Presented below for each of the monitoring objectives is a brief status summary and a list of additional study needs. High priority needs are highlighted in **bold type** and referenced to a potential study in Table 1 and Appendix B.

Physical 1 – Assess physical habitat

STATUS – There are a number of historical, current, and planned studies that will provide much of the basic information needed to assess the physical habitat of the creek and its watershed. Historical studies include: Allardt and Grunsky's 1888 inspection (H22), Portola Valley's visual inspection of Corte Madera Creek in 1984 (H25), Stanford's hydrological study of sedimentation of Searsville Lake (H5), Sokol's thesis on the hydrogeology of the basin (H18), and CCRS's volunteer monitoring (H1) and riparian habitat studies (H23) between Searsville and the Bay, and in the upper subwatersheds (H6). More recent efforts that supplement these historical studies include: Caroline Frey's study of the geomorphic conditions above Searsville (H29 = C7); the existing conditions report (H32 = C14) sponsored by agencies in the lower watershed; the National Park Service's inventory of stream habitat conditions on West Union Creek (C13); and Stanford's

2.5 Implementation in Fiscal Year 2001/02

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annual reports on stream flow and sediment transport above Searsville (H33 = C15), analyses of sediment cores from Searsville (C19), and the study of sediment impacts downstream of Searsville under different management scenarios (H34 = C16). In addition, San Francisquito Watershed Council studies of barriers to fish migration (H30 = C8) and monitoring in the Bear Creek watershed (C12) will provide data on sediment in this subwatershed. Portola Valley's stream flow hazard study (C28) will evaluate the performance of in-creek structures over the last 17 years and the Watershed Council is creating an inventory of known migration barriers and impediments throughout the watershed (C32). The analyses of data leading to development of an erosion control and prevention plan by San Mateo agencies (C17) should provide information on sediment as it relates to fish and flooding. USGS's overland sediment transport model project in the upper watershed (C30 = P1) should support the San Mateo agencies' efforts as well as those of the Regional Board to develop a sediment TMDL by 2005/2006.

The mitten crab, an invasive species, has been found all along the San Francisquito Creek.

Needs

- Searsville dam removal feasibility study (P2)
- Existing conditions report for upper watershed (i.e., repeat study similar to study C14 above Junipero Serra Blvd.) (P3)
- Extent and impact of mitten crab invasion study (P4)
- Habitat evaluation for beneficial use and listed species protection (P5)
- Follow-up on evaluation of sediment sources above Searsville and evaluation of sources in creeks not previously studied (P11)
- Barrier retrofit/removal study (P28)
- Feasibility study on removal of north levee through wetlands (P29)
- Riparian habitat survey of upper watersheds (P30)
- Post-project monitoring for bank stabilization and revegetation projects (P31)

Physical 2 – Assess land use impacts

Status – There are disparate sources of data that are now being assembled under study C24 – Development of GIS and Maps for San Francisquito Creek and study C33 – Digital Information Resource for Fish Recovery (NOAA) that should provide much but not all of the data necessary to assess existing and projected land use impacts. These data sources include historical studies such as: San Mateo stormwater program's impervious cover estimates (H8), the SCBWMI's Watershed Characteristics Report (H9), ABAG's land use maps (H11), the San Francisquito Watershed Council's Reconnaissance Report (H15), and USGS's High Resolution National Hydrography Dataset (H39). The Regional Board's storm drain mapping project in Santa Clara County (C18) will provide additional data as will the watershed boundaries update project being conducted by the SCBWMI (H36 = C23). The Santa Clara Valley Water District's topographic survey and hydraulic modeling of the lower watershed (H35 = C22) combined with USGS's overland sediment transport model project in the upper watershed (C30 = P1) should provide important analytical tools. In terms of assessment, Portola Valley's creekside corridor report (H12) and the SCBWMI's comparison of development policies (H13) provide some of the information necessary for a more comprehensive assessment of existing and projected land use impacts.

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NEEDS

- Surface water hydrology mapping project of Palo Alto and vicinity (P6)
- **Assess impacts of land uses changes on sediment loads (P7)**
- Compare development policies of San Mateo agencies (i.e., repeat study similar to study H13 for those San Francisquito Creek jurisdictions not covered by H13) (P8)

Hydrological 1 – Assess hydrological characteristics related to flooding

STATUS – There appears to be a significant amount of data available to help assess the basic hydrological characteristics of the watershed. For groundwater, there are historical studies such as Sokol's thesis (H18), and USGS reports on geohydrology and water quality (H4) and the effects of pumping on groundwater levels and quality in the San Francisquito cone (H16), as well as an estate development feasibility study (H24). USGS' current study of groundwater recharge and quality in the San Francisquito Creek alluvial fan as well as development of a flow model and budget (C11) plus the Regional Board's evaluation of existing groundwater protection strategies (C26) should provide significant additional information. For surface flows, Allardt and Grunsky's 1888 inspection (H22) and Stanford's hydrological study of sedimentation of Searsville Lake (H5) are supplemented by a number of current efforts that provide some hydrological information including: Jim Carter's study of lotic macroinvertebrates (C1), the San Francisquito Watershed Council's monitoring in the Bear Creek watershed (C12), and water flow and/or level measurements of the creek by USGS (C2) and Palo Alto (C5). Flood zone information is available from the FEMA maps (H19) and the SCVWD's report on the 1998 flood (H20), and this information was used in developing boundaries via the SCBWMI's watershed boundaries update project (H36 = C23) and the San Francisquito Watershed Council/USGS's Development of GIS and Maps for San Francisquito Creek project (C24). Stanford's Searsville Lake Sediment Impact Study (H34 = C16) and the SCVWD's topographic survey will provide modeling information on rainfall/runoff and stage/discharge relationships for the lower watershed (i.e., below Searsville) (H35 = C22). And USGS's overland sediment transport model project (C30 = P1) should provide important analytical tools for the upper watershed.

NEEDS

- Accounting of water supplies and uses in the watershed (P10)
- Feasibility study on removal of north levee through wetlands (P29)

Hydrological 2 – Assess hydrological characteristics related to habitat

STATUS – As it appears for objective Hydrological 1, there seem to be a significant amount of data available to help assess flow regimes of the watershed as they relate to habitat needs. In addition to many of the studies mentioned under Hydrological 1, CCRS's volunteer monitoring study in the upper subwatersheds (H6), the San Francisquito Watershed Council's study of barriers to fish migration in the Bear Creek watershed (H30 = C8), and Stanford's survey's of biotic diversity (H31 and= C10) should all provide important information.

NEEDS

- Accounting of water supplies and uses in the watershed (P10)
- Study similar to studies C10 and H6 – measuring and assessing habitat conditions, particularly locations, levels, and quality of water, relative to habitat needs (P13)

2.5 Implementation in Fiscal Year 2001/02

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Chemical 1 – Assess known (303(d)) pollutants

STATUS – Recently completed monitoring efforts by the City of Palo Alto (H27 = C4) at three sites in the lower watershed, and ongoing efforts by the San Francisquito Watershed Council in the Bear Creek watershed (C12) and the establishment of long-term monitoring stations at three sites (C29) can provide a significant portion of the data needed to assess "known" pollutants (i.e., diazinon and sediment). In addition, sampling of storm drain outfalls by Kristen Sipes (H28 = C6) should provide information on these man-made "tributaries" to the creek.

NEEDS

- **Establishment of additional long-term monitoring sites at: San Francisquito Creek @ Searsville Dam, Bear Creek @ Sand Hill Road, and Corte Madera Creek @ Westridge Road to complement the three other watershed sites (P15)**
- **Standardization of the parameters measured and protocols used at the six long-term sites (P15)**
- **Evaluation of known pollutant impacts on aquatic uses through comparisons to criteria and follow-up toxicity tests (see objective Biological 3) (P16)**

Chemical 2 – Assess other pollutants

STATUS – In addition to the studies mentioned under Chemical 1, the following studies should all provide important information on other potential pollutants: Jasper Ridge's water quality monitoring around Searsville (C9), the Santa Clara Valley Urban Runoff Pollution Prevention Program's (SCVURPPP) analysis of sediments for PCBs and mercury at several sites in the watershed (C20), Cal Water's annual Bear Gulch water quality report (C21), and USGS's analysis of pesticides in sediment cores from the tidal delta. Historical studies by SLAC (H2) and CCRS's volunteer monitoring study in the upper subwatersheds (H6) will provide additional data.

NEEDS

- **Establishment of long-term monitoring sites at: San Francisquito Creek @ Searsville Dam, Bear Creek @ Sand Hill Road, and Corte Madera Creek @ Westridge Road to complement the three other watershed sites (P15)**
- **Standardization of the parameters measured and protocols used at the six long-term sites (P15)**
- **Evaluation of other pollutant impacts on aquatic uses through comparisons to criteria and follow-up toxicity tests (see objective Biological 3) (P16)**
- **Survey and characterize the spatial and temporal extent of trash (P32)**

Volunteers monitoring water quality in the San Francisquito watershed.

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Biological 1 – Assess biological habitat

STATUS – Current and historical monitoring efforts can provide a significant portion of the data needed to assess the biological habitat. Historical studies include: twenty-nine fish surveys conducted by the Department of Fish & Game between 1974 and 1996 (H21), and CCRS's volunteer monitoring studies (H1) and riparian habitat studies (H23) between Searsville and the Bay and in the upper subwatersheds (H6). Recently completed and current efforts that supplement these historical studies include: Jim Carter's study of lotic macroinvertebrates (C1) in the perennial portions of San Francisquito Creek, Los Trancos Creek, and Corte Madera Creek, the San Francisquito Watershed Council's study of barriers to fish migration in the Bear Creek watershed (H30 = C8), Stanford's survey of biotic diversity in the riparian corridor between the San Francisquito and Los Trancos creeks confluence, Felt Lake, and the lower portion of Bear Creek within Jasper Ridge Biological Preserve (H31 and C10), the existing conditions report (H32 = C14), and NPS-GGNRA's fish and habitat inventory on West Union Creek (C13). New efforts to measure macroinvertebrates in the vicinity of the long-term monitoring stations (C29) and to produce a Digital Information Resource for Fish Recovery (C33) should also provide important habitat data.

NEEDS

- Distribution of lotic macroinvertebrates in Bear Creek watershed (i.e., repeat study similar to study C1 for this key upper subwatershed) (P17)
- Identification and evaluation of impacted habitats, and population and community structures (i.e., repeat study similar to study C10 on non-Stanford lands) (P20)
- Barrier retrofit/removal study (P28)
- Feasibility study on removal of north levee through wetlands (P29)
- Riparian habitat survey of upper watersheds (P30)

Biological 2 – Assess biodiversity

STATUS – In addition to many of the studies mentioned under Biological 1, Rob Leidy's fish assemblage data at locations near the proposed long-term monitoring sites (H3) should provide important information. At a genetic level, the analysis of mitochondrial DNA and microsatellite loci in San Francisquito Creek rainbow trout by Jennifer Nielsen (H17) and the determination of genetic relationships among different populations of steelhead/rainbow trout by SJSU (C25/C27) will provide more detailed biodiversity information.

NEEDS

- Update fish and fish habitat surveys (i.e., repeat study similar to study C10 (Stanford lands) and study C13 (GGNRA lands) in other tributaries) (P14)
- Determination and comparison of genetic populations of fish in Los Trancos Creek and Searsville Lake watersheds (i.e., repeat study similar to study H17 and study C25/C27 on fish in these watersheds) (P19)
- Identification and evaluation of impacted habitats, and population and community structures (i.e., repeat study similar to study C10 on non-Stanford lands) (P20)

Biological 3 – Assess toxicity

STATUS – There are no known existing or planned studies of the toxicity of water and sediment from San Francisquito Creek or its tributaries, or from other waterbodies in the watershed.

NEEDS

- **Add toxicity testing to the existing (C20 and C29) and planned (P15) monitoring programs for the six long-term sites and to testing programs for waterbodies providing aquatic habitat**
- Follow-up toxicity tests and source identifications and evaluations when concentrations of known and other pollutants measured as part of studies for objectives Chemical 1 and Chemical 2 indicate potential impacts to aquatic uses (P21)

2.5 Implementation in Fiscal Year 2001/02

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Biological 4 – Assess human health impacts

STATUS – There are no known existing or planned studies of water quality parameters (e.g., coliform, pathogens) indicative of potential public health impacts for San Francisquito Creek or its tributaries, and no readily available data for other waterbodies in the watershed.

NEEDS

- **Add testing for water quality parameters (e.g., coliform, pathogens) indicative of potential public health impacts to the monitoring programs for the six long-term sites and to testing programs for waterbodies used for recreation (P22)**
- Identify potential causes/sources of pathogen exposure and effects when water quality parameters indicate potential public health impacts (P23)

Social 1 – Assess community values

STATUS – There are limited data available to assess the community's concerns about the creek and its watershed. A public survey conducted by the SCVURPPP for the whole Santa Clara Basin provides some information from San Francisquito Creek watershed residents (H14). A new project by USGS to empower citizens to use "integrated multidiscipline information" for community-based decision-making through a computer-based Decision Support System (C31) may facilitate or precipitate the assessment of the community's concerns about the creek.

NEEDS

- **Survey opinions, concerns, interests, and activities of residents, businesses, and community organizations regarding the watershed, its resources and use, and their willingness to pay to address these things (P12, P24)**

Social 2 – Assess social characteristics of watershed

STATUS – There is very little compiled information on the social characteristics (e.g., demographics, population density, income, home ownership, libraries, interpretive sites, business information, and access points) for the watershed. The existing conditions report (H32 = C14) provides a summary of cultural and historical information.

NEEDS

- Compile social inventory based on templates from SCVURPPP and SFEI (P9)

Social 3 – Assess human impacts

STATUS – The SCBWMI's Watershed Characteristics Report (H9) provides general physical and political characteristics of the Santa Clara Basin. NOAA's effort to produce a Digital Information Resource for Fish Recovery (C33) should provide some information on the impacts of timber harvests, agriculture, urban growth, and land management on salmonid populations.

NEEDS

- Inventory of current human impacts (P25)
- More specific "historical ecology" of the San Francisquito Creek watershed documenting environmental change through time (P27)
- **Survey and characterize the spatial and temporal extent of trash (P32)**

3.0 References

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Table 1. Elements of the San Francisquito Creek Long-Term Monitoring and Assessment Plan.

This table shows the connection between management questions (right) and monitoring objectives (left), including specific monitoring and assessment activities in between. For each activity the following items are presented: parameters to measure, the spatial and temporal extent of monitoring, monitoring locations and frequency, existing (current or historical) monitoring projects that relate to the objective, potential projects to fill data gaps, and related management questions. Appendix B presents basic information about current, potential, and selected historical studies. *Italics indicate an assessment function as opposed to a monitoring function.*

To facilitate identifying individual studies, the following alphanumeric nomenclature is used:

C# = Current study (e.g., C29 – Long-term Water Quality Monitoring)
H# = Historical study (e.g., H22 – Allardt and Grunsky's 1888 inspection)
P# = Potential study (e.g., P15 – Long-term monitoring of upper watersheds)

To facilitate tracking studies when their status changes (e.g., from a current study to a historical study), present and past designations are shown: H30 = C8 Adult Steelhead Passage in the Bear Creek Watershed

LTMAP OBJECTIVE	MONITORING/ ASSESSMENT	PARAMETERS	SPATIAL EXTENT	TEMPORAL EXTENT	PREFERRED FREQUENCY	CURRENT/HISTORICAL STUDIES	POTENTIAL STUDIES	RELATED MOTIVE(S)/ MANAGEMENT QUESTION(S)
Physical 1 - Assess physical habitat	Derive sediment budget	Sediment quantities, areas of supply and deposition; particle size distributions	Throughout watershed		Snapshot once every 5 years and following catastrophic events or other significant change	C17 - Watershed Analysis and Sediment Reduction Plan, C19 - Searsville Core Sample Analysis, C30 (P1) - Overland Sediment Transport Model in the Upper Watershed, H5 - Sedimentation and Channel Dynamics, H18 - Hydrogeology of the San Francisquito Creek Basin, H34 (C16) - Searsville Lake Sediment Impact Study		Clean Water Act 305(b)/303(d) listing, local flood prevention/ control (JPA), Special Status Species, SFWC priorities, Regional MAS.
	Inventory physical characteristics	Erosion, deposition, & bank stability; barriers; in-stream sediment embeddedness and substrate condition; riffle, run and pool structure; vegetation/cover, and restoration success	Throughout watershed		Update every 5 years and after catastrophic events or other significant change	C12 - Water Quality Assessment, C13 - West Union Creek Habitat/ Fish Inventory, C28 - Stream Flow Hazards Evaluation, C30 (P1) - Overland Sediment Transport Model in the Upper Watershed, C32 (P18) - Known Barriers/Impediments to Migrating Steelhead, H1 - Pilot Volunteer Monitoring, H6 - Upper Watershed Volunteer Monitoring, H22 - Inspection of San Francisquito Creek, H23 - San Francisquito Creek Riparian Habitat Report, H25 - Preliminary Assessment of Corte Madera Creek, H29 (C7) - Geomorphic Study of Searsville Lake Watershed, H30 (C8) - Adult Steelhead Passage Study, H33 (C15) - Annual Hydrologic Reports for Searsville Lake Watershed, H34 (C16) - Searsville Lake Sediment Impact Study, H38 - Annual Hydrologic Report and Preliminary Sediment Budget for Upper Los Trancos Creek	P3 - Existing conditions for upper watershed, P4 - Extent and impact of mitten crab invasion, P11 - Follow-up evaluation of the sources of sediment, P30 - Riparian habitat survey - upper watershed	Clean Water Act 305(b)/303(d) listing, local flood prevention/ control (JPA), Special Status Species, SFWC Priorities, Regional MAS.

Table 1. Elements of the San Francisquito Creek Long-Term Monitoring and Assessment Plan.

LTMAP OBJECTIVE	MONITORING/ ASSESSMENT	PARAMETERS	SPATIAL EXTENT	TEMPORAL EXTENT	PREFERRED FREQUENCY	CURRENT/HISTORICAL STUDIES	POTENTIAL STUDIES	RELATED MOTIVE(S)/ MANAGEMENT QUESTION(S)
Assessment:	*Assess impacts on biota, habitat*	*Relate to habitat needs for key species, e.g., fish migration, & section 303(d) listing (coordinate with Biol. 1, Biol. 2)*	*Throughout watershed*	*Snapshots and trends over time*	*Update every 5 years and after catastrophic events or other significant change*	*C32 (P18) - Known Barriers/ Impediments to Migrating Steelhead, H30 (C8) - Adult Steelhead Passage Study*	*P2 - Searsville dam removal /feasibility study, P5 - Habitat evaluation, P28 - Barrier retrofit/ removal study, P29 - Feasibility study - Removal of north levee, P31 - Post-project monitoring*	*Clean Water Act 305(b)/303(d) listing, local flood prevention/ control (JPA), Special Status Species, SFWC Priorities, Regional MAS.*
Physical 2 - Assess land use impacts	Compile existing and projected land use and surface drainage data	Land use boundaries, areas and watershed delineations; impervious surface data; surface drainage system layout, coverage	Throughout watershed		Update every 5 years and after catastrophic events or other significant change	C18 - Storm drain mapping project, C24 - Development of GIS maps for San Francisquito Creek watershed, C30 (P1) - Overland Sediment Transport Model in the Upper Watershed, C33 - Digital Information Resource for Fish Recovery, H8 - Impervious Cover Estimates, H9 - Watershed Characteristics Report, H10 - Sharon creek study, H11 - Existing land use maps, H15 - Recon Report, H35 (C22) - Topographic survey and modeling, H36 (C23) - Watershed boundaries update, H39 - High Resolution NHD	P6 - Mapping creek and watershed	Clean Water Act 305(b)/303(d) listing, local flood prevention/ control (JPA), Special Status Species, SFWC Priorities, Regional MAS.
Assessment:	*Assess impacts of land use changes*	*Relate past and projected land use characteristics and changes to changes in surface drainage flow and quality, in-stream flow and quality, habitat, etc. (coord. with Biol. 1, Biol. 2, etc.)*	*Throughout watershed*	*Snapshots and trends over time*	*Update every 5 years and after catastrophic events or other significant change*	*H12 - PV Creekside Corridor Report*	*P7 - Assessment of land use change impacts*	*Clean Water Act 305(b)/303(d) listing, local flood prevention/ control (JPA), Special Status Species, SFWC Priorities, Regional MAS.*
Assessment:	*Assess impacts/effectiveness of land use policies, plans, and ordinances*					*H13 - Comparison of Development Policies*	*P8 - Comparison of development policies - rest of San Mateo jurisdictions*	

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LTMAP OBJECTIVE	MONITORING/ ASSESSMENT	PARAMETERS	SPATIAL EXTENT	TEMPORAL EXTENT	PREFERRED FREQUENCY	CURRENT/HISTORICAL STUDIES	POTENTIAL STUDIES	RELATED MOTIVE(S)/ MANAGEMENT QUESTION(S)
Hydrological 1 - Assess hydrological characteristics related to flooding	Measure hydrological parameters	Rainfall, flows from tribs & discharges to SF Creek, in-stream flows, discharge to SF Bay, withdrawals (compile water rights info)	Throughout watershed	Year-round, wet and dry weather	Annual, ongoing	C1 - Distribution of Lotic Macroinvertebrate, C2 - Daily/ Peak Flows, C5 - Creeks Level Monitoring (lower watershed), C11 -Groundwater Recharge and Budget, C12 - Water Quality Assessment, C26 - Comprehensive Groundwater Protection Evaluation, H4 - Geohydrologic Framework, H5 - Sedimentation and Channel Dynamics, H16 - Ground-Water Development and the Effects, H18 - Hydrogeology of the San Francisquito Creek Basin, H22 - Inspection of San Francisquito Creek, H24 - Hydrologic Investigation: Estate Redevelopment	P10 - Water Management in Pilot Watersheds	Santa Clara Basin WMI, local flood prevention/control (JPA)
Assessment:	*Derive hydrological characteristics*	*Rainfall/runoff and stage/ discharge relationships; flood flows and frequencies; water budget (incl. groundwater exchange)*	*Throughout watershed*		*Update every 5 years and after catastrophic events or other significant change*	*C26 - Comprehensive Groundwater Protection Evaluation, C30 (P1) - Overland Sediment Transport Model in the Upper Watershed, H34 (C16) - Searsville Lake Sediment Impact Study (Searsville Lake to Highway 280), H35 (C22) - Topographic survey and modeling (Highway 280 to Bay), H18 - Hydrogeology of the San Francisquito Creek Basin*	*P29 - Feasibility study - Removal of north levee*	*Santa Clara Basin WMI, local flood prevention/control (JPA)*
Assessment:	*Define watershed features*	*Watershed boundaries, flood zones*	*Throughout watershed*		*Update every 5 years and after catastrophic events or other significant change*	*C24 - Development of GIS maps for San Francisquito Creek watershed, H19 - FEMA Maps, H20 - After the Flood Waters Receded, H36 (C23) - Watershed boundaries update*	*P29 - Feasibility study - Removal of north levee*	*Santa Clara Basin WMI, local flood prevention/control (JPA)*
Assessment:	*Assess flood potential*	*Use real time rainfall and creek flow data to predict flood potential*	*Throughout watershed, particularly urbanized areas*		*Every significant rainfall event*	*C5 - Creeks Level Monitoring (lower watershed)*		

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Hydrological 2 - Assess hydrological characteristics related to habitat	Measure hydrological parameters from Hydro 1 for critical habitat areas, seasons	Flows from tribs & discharges to SF Creek, in-stream flows, discharge to SF Bay, withdrawals (compile water rights info)	Critical habitat areas	Critical seasons re: life stages of species of concern	Update every 5 years and after catastrophic events or other significant change	C1 - Distribution of Lotic Macroinvertebrates, C2 - Daily/Peak Flows, C5 - Creeks Level Monitoring (lower watershed), C12 - Water Quality Assessment, H4 - Geohydrologic Framework, H5 - Sedimentation and Channel Dynamics, H16 - Ground-Water Development and the Effects, H18 - Hydrogeology of the San Francisquito Creek Basin, H24 - Hydrologic Investigation: Estate Redevelopment	P10 - Water Management in Pilot Watersheds, P13 - Identification and assessment of hydrology relative to habitat needs	Endangered Species Act
Assessment:	*Assess flow regimes re: habitat needs*	*Compare hydro. characteristics to habitat needs for key species (coordinate with Biol.1, Biol. 2)*	*Throughout watershed*	*Year-round, wet and dry weather*	*Update every 5 years and after catastrophic events or other significant change*	*H6 - Upper Watershed Volunteer Monitoring, H30 (C8) - Adult Steelhead Passage Study, C10 & H31 - Fishes and Amphibians*	*P13 - Identification and assessment of hydrology relative to habitat needs*	*Santa Clara Basin WMI, Clean Water Act 305(b)/303(d) listing, SFWC issues/priorities*
Chemical 1 - Assess known (CWA 303(d)) pollutants	Collect and analyze water samples	diazinon + field parameters: pH, temp, D.O., EC; est. Flow rate; field obs.	Selected in-stream locations, tribs & discharges to SF Creek, discharge to SF Bay	Year-round; wet and dry weather (when there is flow)	At least monthly	C12 - Water Quality Assessment, C29 - Long-term Water Quality Monitoring, H27 (C4) - Stream Monitoring (lower reaches), H28 (C6) - Assessment of Urban/Rural Runoff	P15 - Long-term monitoring of upper subwatersheds	Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/Priorities; [Regional MAS]
	Collect and analyze sediment samples	diazinon	Selected in-stream locations, tribs to SF Creek, mouth of SF Creek	Year-round; wet and dry weather (when there is flow)	At least monthly		Modify (add diazinon) C20 - Sediment sampling for PCBs and mercury, Modify (add sediment) C29 - Long-term Water Quality Monitoring, P15 - Long-term monitoring of upper subwatersheds	*Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/ Priorities; [Regional MAS]*

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Assessment:	*Assess potential impacts on in-stream aquatic life*	*Compare observed diazinon concentrations to water and sediment quality criteria for protection of aquatic life; relate to CWA 303(d) listing, TMDLs*	*Throughout watershed*	*Snapshots (monitoring events) and trends over time*	*Biannually (prior to 305(b), 303(d) updates) and as needed in response to significant change*		*P16 - Evaluation of pollutant impacts on aquatic life uses*	*Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/Priorities; [Regional MAS]; Endangered Species Act*
Chemical 2 - Assess other pollutants	Collect and analyze water samples	Dissolved/total metals: Al, Cu, Pb, Hg, Ni, Ag, Zn; hardness; TSS; TDS; NO_3; NH_4; P; + field parameters: pH, D.O., temp, EC; est. flow rate; field obs.	Selected in-stream locations, tribs & discharges to SF Creek, discharge to SF Bay (use as screening site for creek)	Year-round; wet and dry weather (when there is flow)	At least monthly	C9 - Jasper Ridge Water Quality, C12 - Water Quality Assessment, C20 - Sediment sampling for PCBs and mercury, C21 - Bear Gulch Water Quality Report, C29 - Long-term Water Quality Monitoring, H2 - Assessment of San Francisquito Creek, H6 - Upper Watershed Volunteer Monitoring, H27 (C4) - Stream Monitoring (lower reaches), H28 (C6) - Assessment of Urban/Rural Runoff	P15 - Long-term monitoring of upper subwatersheds, P32 - Survey and characterize the spatial and temporal extent of trash	Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/Priorities; [Regional MAS]
		For discharge to Bay add: chlordane, DDT, Dieldrin, dioxins, furans, PCBs		Year-round; wet and dry weather (when there is flow)	Quarterly	C29 - Long-term Water Quality Monitoring		
Assessment:	*Assess potential impacts on in-stream aquatic life*	*Compare observed pollutant concentrations to water quality criteria for protection of aquatic life*	*Throughout watershed*	*Snapshots (monitoring events) and trends over time*	*Biannually (prior to 305(b), 303(d) updates) and as needed in response to significant change*		*P16 - Evaluation of pollutant impacts on aquatic life uses*	*Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/ Priorities; [Regional MAS]*
Assessment:	*Assess potential impacts on Bay water and sediment quality*	*Compare observed pollutant concentrations to recorded SF Bay levels*	*South Bay*	*Snapshots (monitoring events) and trends over time*	*Biannually and as needed in response to change*		*P16 - Evaluation of pollutant impacts on aquatic life uses*	*Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/ Priorities; [Regional MAS]*
	Collect and analyze sediment samples	Metals: Cu, Pb, Hg, Ni, Ag, Zn	Selected in-stream locations, tribs to SF Creek, mouth of SF Creek (use as screening site)	Year-round; wet and dry weather (when there is flow)	At least monthly	C20 - Sediment sampling for PCBs and mercury, H2 - Assessment of San Francisquito Creek	Modify (add sediment) C29 - Long-term Water Quality Monitoring	Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/Priorities; [Regional MAS]
		For mouth of Creek add: chlordane, DDT, Dieldrin, dioxins, furans, PCBs		Year-round; wet and dry weather (when there is flow)	At least monthly	C30 (P1) - Overland Sediment Transport Model in the Upper Watershed		

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Assessment:	*Assess potential impacts on Bay water & sediment quality*	*Compare observed pollutant concentrations to recorded SF Bay levels*	*South Bay*	*Snapshots (monitoring events) and trends over time*	*Biannually and as needed in response to change*		*P16 - Evaluation of pollutant impacts on aquatic life uses*	*Clean Water Act 305(b)/303(d) listing; Stormwater NPDES Permits (Santa Clara, San Mateo); SFWC Issues/ Priorities; [Regional MAS]*
Biological 1 - Assess biological habitat	Inventory habitat conditions, including vegetation	Fish spawning/rearing sites, migration routes; macroinvertebrate habitat (lotic, benthic); bird cover/ nesting sites; other?	Throughout watershed	Year-round; wet and dry weather (when there is flow)	Update every 5 years and after catastrophic events or other significant change	C1 - Distribution of Lotic Macroinvertebrates, C13 - West Union Creek Habitat and Fish Inventory, C29 - Long-term Water Quality Monitoring, C33 - Digital Information Resource for Fish Recovery, H1 - Pilot Volunteer Monitoring, H6 - Upper Watershed Volunteer Monitoring, H21 - Fish surveys (29), H23 - Riparian Habitat Project, H30 (C8) - Adult Steelhead Passage Study, C10 & H31 - Fishes and Amphibians, H32 (C14) - Existing Conditions Report	P17 - Factors affecting distribution of lotic macroinvertebrates in the Bear Creek watershed, P30 - Riparian Habitat Survey - Upper Watersheds	Clean Water Act 305(b)/303(d) listing, Special Status Species, SFWC Priorities, Regional MAS.
Assessment:	*Assess habitat quality*	*Evaluate quality of habitat and identify stressed or impacted habitats for selected species (integrate with Phys. 1, Hydro. 1, Chem. 1, Chem 2, Biol. 2); develop vegetation map*	*Throughout watershed*	*Snapshots (monitoring events) and trends over time*	*Update every 5 years and after catastrophic events or other significant change*	*C10 & H31 - Fishes and Amphibians*	*P20 - Identification and evaluation of impacted habitats and population and community structures, P28 - Barrier retrofit/removal, P29 - Feasibility study - Removal of north levee*	*Clean Water Act 305(b)/303(d) listing, Special Status Species, SFWC Priorities, Regional MAS; success of prior revegetation efforts.*
Biological 2 - Assess biodiversity	Field surveys to inventory key populations	Abundance (and ages) of species of interest, incl. state or federally-listed species, plus invasive species or others	Throughout watershed	At crucial life stages for each species inventoried	Update every 5 years and after catastrophic events or other significant change	C1 - Distribution of Lotic Macroinvertebrates, C13 - West Union Creek Habitat and Fish Inventory, C25/C27 - Genetic Relationships Among Steelhead Rainbow Trout Populations, C29 - Long-term Water Quality Monitoring, C33 - Digital Information Resource for Fish Recovery, H3 - Historical Fisheries Studies, H17 - Microsatellite Analysis, H21 - Fish surveys (29), C10 & H31 - Fishes and Amphibians, H32 (C14) - Existing Conditions Report	P14 - Fish and fish habitat surveys, P19 - Determination and comparison of genetic populations of fish in Los Trancos Creek and Searsville Lake watersheds	Clean Water Act 305(b)/303(d) listing, Special Status Species, SFWC Priorities, Regional MAS.

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Assessment:	*Assess population and community structure*	*Evaluate population structure and identify weak or missing age classes, relative abundance, community structure (trophic levels) for selected species (integrate with Phys. 1, Hydro. 1, Chem. 1, Chem 2, Biol. 1)*	*Throughout watershed*	*Snapshots and trends over time*	*Update every 5 years and after catastrophic events or other significant change*	*C10 & H31 - Fishes and Amphibians*	*P20 - Identification and evaluation of impacted habitats and population and community structures*	*Clean Water Act 305(b)/303(d) listing, Special Status Species, SFWC Priorities, Regional MAS.*
Biological 3 - Toxicity testing	Collect water and sediment samples for Toxicity testing	EPA 3 species test (chronic, acute); TIEs (collect samples in conjunction with sampling under Chemical 1/2)	Selected in-stream locations, tribs & discharges to SF Creek, discharge to SF Bay (coordinate with chemical monitoring)	Year-round; wet and dry weather (when there is flow)	In conjunction with selected water/ sediment monitoring events		Water/Sediment - Modify (add toxicity) C29 - Long-term Water Quality Monitoring, P15 - Long-term monitoring of upper sub-watersheds; Sediment - Modify (add toxicity) C20 - Sediment sampling for PCBs and mercury	Clean Water Act 305(b)/303(d) listing, Special Status Species, SFWC Priorities, Regional MAS.
Assessment:	*Assess degree and extent of toxicity*	*Identify toxic effects and sources of toxicants; evaluate seasonality (correlate with Chem. 1, Chem. 2, Biol. 1, Biol. 2)*	*Throughout watershed*	*Snapshots and trends over time*	*Annually*		*P21 - Identification and evaluation of toxic effects and sources*	*Clean Water Act 305(b)/303(d) listing, Special Status Species, SFWC Priorities, Regional MAS.*
Biological 4 - Assess human health impacts	Collect and analyze water samples	Coliform, pathogens; + field parameters: pH, temp, D.O., EC; est. flow rate; field obs.	Selected in-stream locations, tribs & discharges to SF Creek, discharge to SF Bay (coordinate with chemical monitoring)	Year-round; wet and dry weather (when there is flow)	In conjunction with selected water/ sediment monitoring events		P22 - Presence of indicators of human health impacts	SFWC Issues and Priorities
Assessment:	*Assess degree and extent of potential human health impacts*	*Identify potential exposure and effects of pathogens; evaluate seasonality (correlate with Chem. 1, Chem. 2)*	*Throughout watershed*	*Snapshots and trends over time*	*Annually*		*P23 - Identification of potential causes/sources of pathogen exposure and effects*	*SFWC Issues and Priorities*
Social 1 - Assess community values	Survey opinions of watershed residents and users of SF Creek and related wetlands/waters	Views, opinions, concerns and activities of community members	Throughout watershed		Update every 3 - 5 years	C31 - Computer-based Decision Support System, H14 - Public survey	P12 - Willingness to pay survey, P24 - San Francisquito Creek watershed residents survey	Local flood prevention/control, SFWC Issues and Priorities

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Social 2 - Assess social characteristics of watershed	Compile social data	Demographics, income, home ownership, locations of libraries, interpretive sites and access points	Throughout watershed		Update with census and ABAG data	H32 (C14) - Existing Conditions Report	P9 - Community characteristics and demographics	SFWC Issues and Priorities
Social 3 - Assess human impacts	Documentation of environmental change through time	Native landscape and intermediate stages from 1770s to present	Throughout watershed	1770, 1850, 1890, 1925, 1950, 1975, 2000	Not applicable	C33 - Digital Information Resource for Fish Recovery, H9 - Watershed H37 - Effects of Land Use Policies/Practices on Salmonids	P27 - Historical ecology	SFWC Issues and Priorities
	Observations	Litter, encampments, recreation etc.	Throughout watershed		Ongoing		P25 - Inventory of current human impacts, P32 - Survey and characterize the spatial and temporal extent of trash	SFWC Issues and Priorities

Local and Regional Watershed Management

The interest in adopting a watershed management approach has manifested itself in several ways in the San Francisquito Creek watershed over the last several years. These various efforts are summarized below, along with impending deadlines and a description of some of the benefits to local jurisdictions of monitoring and assessment. The geographic scope of these efforts has included San Francisquito Creek, its watershed, and its floodplain.

San Francisquito Watershed Council (formerly known as the CRMP) – In late 1993, using a watershed management approach and bringing together all the major stakeholders, the Peninsula Conservation Center Foundation initiated a broad-based collaborative process—Coordinated Resource Management and Planning (CRMP)—to develop a Draft Watershed Management Plan for San Francisquito Creek. The document describes goals and proposed actions in six areas: natural resource preservation, flood and erosion control, pollution prevention, land use and development, social issues, and public education and involvement. In October 1998, members of the CRMP Steering Committee met to develop and rank watershed issues; out of this meeting, "ongoing monitoring and survey of natural resources" was by far the top priority. Suggestions for specific activities covered the gamut from chemical and physical parameters to biological and social measures of watershed health and function. Data will need to be expressed in terms meaningful to residents (e.g., fishable, swimable, enjoyable).

Deadlines - There are no established deadlines.

Benefits of Monitoring and Assessment - With a more complete picture of the watershed, the San Francisquito Watershed Council will be able to help the Joint Powers Authority (JPA; see below), watershed residents, regulatory agencies and others set priorities, consider options, and make informed resource management decisions. A plan will help identify and prioritize information needs, and provide a means of coordinating the various monitoring and assessment activities in the watershed.

JPA – As a result of significant flooding in the lower reaches of San Francisquito Creek in February 1998, the cities of East Palo Alto, Palo Alto, and Menlo Park, along with the Santa Clara Valley Water District and San Mateo County Flood Control District, formed a Joint Powers Authority in May 1999. In March 2000, both the CRMP and Stanford University were admitted to the JPA as non-voting associate members. The purpose of the JPA is to manage joint contribution of services and provide policy direction on issues of mutual concern relating to San Francisquito Creek, including bank stabilization; channel clearing and other creek maintenance; planning of flood control measures; preserving and enhancing environmental values and instream uses; and emergency response coordination. Concurrent with the flood, the City of Menlo Park (and later the other local jurisdictions in the lower watershed – East Palo Alto, Palo Alto, San Mateo County Flood Control District and Santa Clara Valley Water District) initiated development of a Bank Stabilization and Revegetation Master Plan for the reach downstream of Junipero Serra Blvd. to Highway 101. The Master Plan is guidance for agencies and property owners to use as a foundation for planning, design, permitting, and construction of future creek stabilization and revegetation projects.

The Joint Powers Authority was formed in large part to facilitate a watershed-based approach to preventing and managing floods. The JPA will need data on runoff volumes and creek flows, creek capacities, and flood zones to make decisions. An Interagency Group reviewed the Master Plan and suggested that projects consistent with the Master Plan could be expedited using a Regional General Permit. The Permit would be issued to a Local Project Oversight Body (e.g., the JPA) that would manage project implementation and a mitigation bank, and oversee required monitoring.

Deadlines - There are no established deadlines. Monitoring of changes in bank stabilization and revegetation will be required on a project-by-project basis to ensure compliance with a permit and to ensure that mitigation is successful in replacing displaced habitat.

Benefits of Monitoring and Assessment – A more temporally and spatially complete assessment of the watershed's runoff potential and the key determinants of creek flows will greatly aid flood management and preparation efforts. More real-time data will facilitate flood prediction and emergency response. Post-project monitoring of implementation of the Master Plan will help evaluate and refine decision-making, as well as identify the need for future actions.

SCBWMI – The Santa Clara Basin is defined as the basin is the land area that drains to San Francisco Bay south of the Dumbarton Bridge (i.e., South San Francisco Bay). The San Francisquito Creek watershed is the northernmost watershed on the west side of the Basin. The South Bay faces constant water quality threats from pollution due to its unique physical characteristics and location adjacent to a major urban area. To provide an opportunity for local stewardship of the watershed, to address all sources of pollution that threaten South San Francisco Bay, and to protect water quality throughout Santa Clara Basin, the USEPA, the State Water Resources Control Board, and the San Francisco Bay Regional Water Quality Control Board initiated the Watershed Management Initiative (SCBWMI) in 1996.

A major aim of the SCBWMI is to develop a Watershed Action Plan that will coordinate existing regulatory activities on a basin-wide scale, ensuring that problems are addressed efficiently and cost-effectively. One of the first steps in the process of developing a Watershed Action Plan is to complete a scientific assessment of conditions in the Santa Clara Basin. The assessment will be based solely on existing data and identify data gaps. It is likely that insufficient data exist to assess some streams and stream reaches. The SCBWMI has selected San Francisquito Creek as one of three pilot watersheds in the Santa Clara Basin to be assessed in the first phase of the SCBWMI. The resulting Watershed Assessment Report will describe past and present efforts. A plan is needed to define the future of assessments in the watershed that is consistent with the other management efforts described herein and the regulatory drivers discussed in the next section.

Deadlines

- Abridged Watershed Characteristics Report for Santa Clara Basin (Vol. 1) – May 2000
- Unabridged Watershed Characteristics Report for Santa Clara Basin (Vol. 1) – February 2001
- Draft Watershed Assessment Report for San Francisquito Creek (Vol. 2) – June 2002. This report will include monitoring recommendations.

Benefits of Monitoring and Assessment – As one of the first watersheds to be assessed, a long-term monitoring plan for San Francisquito Creek will act as a pilot for the development of similar plans for the Santa Clara Basin and individual watersheds.

Regional Monitoring and Assessment Strategy – As described below, the Clean Water Act requires that the Regional Water Quality Control Board assess the condition of Bay Area waterbodies (CWA section 305(b)) and prepare a list of waterbodies that are not meeting water quality standards (CWA section 303(d)) every two years. To help meet these requirements, in October 1999, the Regional Board released its Regional Monitoring and Assessment Strategy. The purpose of the Strategy is to improve the technical basis of 305(b) reports and 303(d) listings by guiding how watershed assessments are conducted and used. The Strategy will lead to the development of: environmental indicators and protocols for their measurement, a waterbody classification scheme, and an information management plan. The Regional Board sought watersheds to pilot test implementation of the Strategy, and San Francisquito Creek was volunteered because of its status as one of three pilot watersheds in the Santa Clara Basin WMI.

DEADLINES - The strategy has the following deadlines relevant to San Francisquito Creek:

- Selection criteria for pilot watersheds – Sep. 1999
- Preliminary list of pilot watersheds – March 2000; Final list – July 2000
- Preliminary assessments of Regional Board-led pilot watersheds – 2002

BENEFITS OF MONITORING AND ASSESSMENT – It's likely that use of San Francisquito Creek as a pilot watershed will provide local jurisdictions and organizations the following:

- Opportunities to define how the Regional Board's Strategy is implemented before it is "finalized" – The Regional Board views the Strategy as dynamic and open to refinement with the assistance of stakeholders like municipal governments.
- Priority funding status for federal and state grants – The Regional Board sets priorities for some grant funds and can make recommendations on funding priorities for grant funds controlled by other agencies (e.g., Department of Fish & Game).
- Regional Board staff resources – Pilot watersheds will receive more attention and staff time from the Regional Board.
- Some level of regulatory relief – Although the Regional Board can't promise that regulatory actions (e.g., new listings of impairment) will "stand still" for pilot watersheds, for all intents and purposes, the Regional Board will be less likely to take regulatory actions while it is studying the watershed. In addition, any future regulatory action will have the benefit of much more information via the pilot work than previous actions that were based on limited information.

INCLUDE – Scientists and scientific organizations are being encouraged to investigate issues relevant to society and to incorporate scientific information into public policy. To meet this challenge, the United States Geologic Survey (USGS) Center for Science Policy in Menlo Park is developing a participatory educational and decision-support process that facilitates interaction among private and public sector decision-makers, other stakeholders, and scientific experts. The process, referred to as Integrated-science and Community-based Land Use Decision making (INCLUDE), will apply scientific research information to complex land-use problems, to help clarify the variables and uncertainties associated with alternative policy scenarios, and provide scientific information to help mitigate conflicts among competing interests. USGS has proposed to use the INCLUDE process to explore options for addressing erosion and sedimentation in the San Francisquito Creek watershed.

DEADLINES - There are no established deadlines.

BENEFITS OF MONITORING AND ASSESSMENT – USGS is actively pursuing long-term funding to support the INCLUDE process and to help local jurisdictions with their monitoring and assessment needs. The first area of interest is sediment and the development of a sediment budget, as this relates to several issues, including the sediment TMDL, the sedimentation of Searsville Lake, and local flooding potential.

Regulatory Drivers

Several sets of regulations affect the management of San Francisquito Creek, as described below. These regulations specify various requirements affecting local jurisdictions and provide motivation for local watershed monitoring and assessment activities.

Clean Water Act – Clean Water Act (CWA) section 305(b) requires that the health of waterbodies be assessed every two years. CWA section 303(d) requires that waterbodies not meeting water quality standards (i.e., impaired or threatened waters) be identified ("listed") every two years. CWA 303(d) listings often result from 305(b) assessments. In May 1999, USEPA listed San Francisquito Creek as impaired due to excessive levels of diazinon and sediment in the creek. CWA 303(d) listings trigger the need to establish a TMDL (Total Maximum Daily Load) which sets a limit on the "load" of a pollutant that can be discharged into the listed waterbody, and allocates pollutant reductions among dischargers. The 1999 listing is based on limited data for both diazinon and sediment, and implies de facto that all of San Francisquito Creek is impaired all the time. The creek's tributaries are not specifically named in the listing but are considered part of the listing via the Regional Board's "tributary rule." One of the first steps in developing a TMDL will be to develop a "problem statement" which includes confirming the impairment listing.

Deadlines

- The next 305(b) reports and proposed changes to the 303(d) listings - Fall 2002
- Diazinon TMDL including Implementation Plan - June 2003
- Sediment TMDL including Implementation Plan - June 2004

Benefits of Monitoring and Assessment - Additional data can be used to produce a more accurate and complete 305(b) assessment. An improved assessment will better define pollutant sources and help focus efforts on cost-effective solutions. More data will also be helpful in the review and revision, as necessary, of the 303(d) listings. (The listings could be rescinded (delisted) or refined.)

Basin Plan – By law, the Regional Water Quality Control Board is required to develop, adopt (after public hearing), and implement a Water Quality Control Plan (Basin Plan) for the San Francisco Bay Region. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the San Francisco Bay region. Aquatic ecosystems and underground aquifers provide many different benefits. The Basin Plan must include a statement of benefits or "beneficial uses" that the Regional Board will protect. Beneficial uses are established by the Regional Board for individual water bodies. For the San Francisquito Creek watershed, the most recent Basin Plan (1995) lists the following beneficial uses:

WATERBODY	SAN FRANCISQUITO CREEK*	FELT LAKE	SEARSVILLE LAKE
Agricultural Supply	—	Existing	Existing
Cold Freshwater Habitat	Existing	—	Existing
Fish Migration	Existing	—	—
Water Contact Recreation	Potential	Existing	Existing
Noncontact Water Recreation	Potential	Existing	Existing
Fish Spawning	Existing	Existing	Existing
Warm Freshwater Habitat	Existing	Existing	Existing
Wildlife Habitat	Existing	Existing	Existing

* (and its tributaries including Los Trancos and West Union Creeks; Bear Creek is not listed in the Basin Plan)

Stream Protection Policy & Strategy – In response to direction from members of its governing Board and requests from the regulated community, Regional Water Quality Control Board staff have begun developing a Bay Area Stream Protection Policy. The Regional Board and USEPA have decided that current regulatory mechanisms do not adequately protect creeks and headwater streams. Often, mitigation for land development and in-stream projects only replaces riparian (i.e., creek bank) function, and there is no mitigation for loss of stream functions like water percolation, flood flow detention, water conveyance, and sediment transport. This contributes to cumulative impacts, including added maintenance costs, and direct and significant water quality impacts. The policy will describe how protecting stream functions will protect beneficial uses; and the policy will define performance objectives (i.e., expected functions) for different stream types. The stream protection policy will include a technical framework for linking stream functions to beneficial uses, narrative water quality objectives for protecting beneficial uses through protection of stream functions, recommended management practices for minimizing adverse impacts to streams and stream corridors, and preliminary policy recommendations, along with priorities for future policy improvements. The policy is being preceded by the development of "pre-project planning guidance" for assessing the potential impacts of land use changes on stream stability. Currently, Regional Board staff is evaluating permit applications using increased knowledge of river science. Regional Board staff expects to produce a Draft Stream Protection Policy by Spring 2002.

DEADLINES –

- Pre-project planning guidance – Fall 2001
- Draft Staff Report – Spring 2002
- Public and Technical Workshops – Summer 2002

BENEFITS OF MONITORING AND ASSESSMENT – Similar to the Endangered Species Act critical habitat functions, defining the limiting factors in the proper functioning of the creek/riparian system will significantly assist agencies in assessing potential impacts of proposed projects on beneficial uses and planning for avoidance or mitigation.

Storm Water Permits – With the promulgation of the federal storm water regulations in 1990, responsibility for managing urban watersheds was conveyed to some degree upon cities, counties, and industries via storm water National Pollutant Discharge Elimination System (NPDES) permits. Discharges of storm water runoff into San Francisquito Creek are regulated by NPDES permits from the Regional Board. The county, cities, and towns in San Mateo are regulated under one permit while those on the Santa Clara side of the creek are regulated by another permit. Collection and assessment of information by local storm water permittees is required under monitoring provisions in their permit.

The new (1999) San Mateo permit has requirements to report exceedances of water quality standards (provision C.2), and to develop pollution reduction and control plans (provision 10). In addition, the Regional Board needs help to do 305(b) assessments and environmental groups are invoking CWA and NPDES permit provisions in seeking more clear and formal monitoring programs. Municipalities will need to respond to remain in compliance with their permits. To be effective partners in watershed management, regulatory agencies and local storm water permittees must work out shared expectations as to how and by whom assessments will be conducted, how much and what types of data will be needed to make decisions, and what kinds of decisions must be made.

The Santa Clara Valley Urban Runoff Pollution Prevention Program's 2001 permit includes the following provisions related to monitoring:

- C.3.f. – Requires the program to develop a Hydrograph Modification Management Plan (HMP). The HMP is to be implemented so that post-project runoff does not exceed estimated pre-project rates and/or durations, where the increased stormwater discharge rates and/or durations will result in increased potential for erosion or other adverse impacts to beneficial uses, attributable to changes in the amount and timing of runoff. The HMP must include "evaluation protocols," which may include:
  - evaluation of the cumulative impacts of urbanization of a watershed on stormwater discharge and stream morphology in the watershed and
  - evaluation of stream form and condition, including slope, discharge, vegetation, underlying geology, and other information, as appropriate.
- C.7 – Development of a monitoring program designed to achieve the following objectives:
  - Characterization of representative drainage areas and stormwater discharges, including land-use characteristics, pollutant concentrations, and mass loading;
  - Assessment of existing or potential adverse impacts on beneficial uses caused by pollutants of concern in stormwater discharges, including an evaluation of representative receiving waters;
  - Identification of potential sources of pollutants of concern found in stormwater discharges; and
  - Evaluation of effectiveness of representative stormwater pollution prevention or control measures.
- C.9.e.i. – Characterization of the distribution of PCBs and dioxin-like compounds in the urban areas of the Santa Clara basin.
- C.9.f.i. – Requires the SCVURPPP to conduct a watershed analysis of San Francisquito Creek in cooperation with the San Mateo Countywide Stormwater Pollution Prevention Program.

Deadlines – The 1999 San Mateo stormwater permit has the following deadlines:

- Provision C.2 – Water quality standards exceedances report (i.e., "Reasonable Potential Analysis") – Sept. 2000
- Provision 10 – Erosion control and prevention plan, and diazinon toxicity reduction plan – March 2002

The Santa Clara Valley Urban Runoff Pollution Prevention Program's 2001 permit has the following deadlines:

- Provision C.3.f – Hydrograph Modification Management Plan – Fall 2003
- Provision C.7 – Annual Monitoring Program Plan – March of each year
- Provision C.9 – Final Five-Year Receiving Waters Monitoring Plan – March 2002
- Provision C.9.f.i – Watershed analysis of San Francisquito Creek – September 2003

Benefits of Monitoring and Assessment – Municipalities can use additional data to better direct their storm water management programs (SWMPs) and communicate the information to their residents. Information on stormwater runoff quality and quantity can be used in establishing TMDLs and in other watershed planning efforts.

Endangered Species Act (ESA) – Effective March 17, 2000, the National Marine Fisheries Service (NMFS) officially designated critical habitat for steelhead trout, including San Francisquito Creek and its tributaries downstream of Searsville Lake. Critical habitats are defined as those areas possessing the physical or biological features essential to the conservation of steelhead trout and which may require special management considerations or protection. Critical habitats include adjacent riparian areas that provide the following functions: shade, sediment transport, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter.

The physical and biological features that create properly functioning habitat vary throughout a species' range, and the extent of the riparian zone may change, depending on the landscape. As a result, site-specific analyses provide the best means to characterize the adjacent riparian zone.

In addition to steelhead, several others species common to the San Francisquito Creek watershed are listed by the state or federal government as threatened or of concern, including: California red-legged frog, Western pond turtle, and California tiger salamander, and several riparian bat species.

In June 2000, NMFS adopted a rule prohibiting the "take" of 14 groups of salmon and steelhead listed as threatened under the Endangered Species Act. NMFS adopted the take rule under section 4(d) of the ESA. This rule prohibits anyone from taking a listed salmon or steelhead, except in cases where the take is associated with an approved program. The 4(d) rule approves some specific existing state and local programs, and creates a means for NMFS to approve additional programs if they meet certain standards set out in the rule. Based on available information, NMFS believes the categories of activities listed below are those activities that, as a general rule, are most likely to harm listed fish:

A. Constructing or maintaining structures like culverts, berms, or dams that eliminate or impede a listed species' ability to migrate or gain access to habitat.

B. Discharging pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water (including sewage water) into a listed species' habitat.

C. Removing, poisoning, or contaminating plants, fish, wildlife, or other biota that the listed species requires for feeding, sheltering, or other essential behavioral patterns.

D. Removing or altering rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and function of a listed species' habitat.

E. Removing water or otherwise altering stream flow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.

F. Releasing non-indigenous or artificially propagated species into a listed species' habitat or into areas where they may gain access to that habitat.

G. Constructing or operating dams or water diversion structures with inadequate fish screens or passage facilities.

H. Constructing, maintaining, or using inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.

I. Conducting timber harvest, grazing, mining, earth-moving, or other operations that substantially increase the amount of sediment going into streams.

J. Conducting land-use activities that may disturb soil and increase sediment delivery to streams—such as logging, grazing, farming, and road construction—in riparian areas and areas susceptible to mass wasting and surface erosion.

K. Illegal fishing. Harvest that violates fishing regulations will be a top enforcement concern.

L. Various streambed disturbances may trample eggs or trap adult fish preparing to spawn. The disturbance could be mechanical disruption caused by constructing push-up dams, removing gravel, mining, or other work in a stream channel. It may also take the form of egg trampling or smothering by livestock in the streambed or by vehicles or equipment being driven across or down the streambed (as well as any similar physical disruptions).

M. Illegal interstate and foreign commerce dealing in, imports, or exports listed salmon or steelhead.

N. Altering lands or waters in a manner that promotes unusual concentrations of predators.

O. Shoreline and riparian disturbances (whether in the river, estuary, marine, or floodplain environment) may retard or prevent the development of certain habitat characteristics upon which the fish depend (e.g., removing riparian trees reduces vital shade and cover, floodplain gravel mining, development, and armoring shorelines reduces the input of critical spawning substrates, and bulkhead construction can eliminate shallow water rearing areas).

P. Filling or isolating side channels, ponds, and intermittent waters (e.g., installing tide gates and impassable culverts) can destroy habitats that the fish depend upon for refuge during high flows.

The FishNet 4C Program was started by County Supervisors in four counties, including San Mateo. The program is designed to meet NMFS requirements for protecting listed species, including the 4(d) rule. FishNet 4C recommendations for monitoring include:

- Identify and map anadromous fish streams and tributaries
- Develop a program to identify poorly located infrastructure and road segments
- Identify, evaluate, and prioritize county facilities that are barriers to salmonid migration

Deadlines

- Rule prohibiting take of steelhead – September 8, 2000
- The listings of critical habitat and adoption of a rule prohibiting the take of steelhead under the ESA mean that communities could face significant changes in how they approach such diverse activities as: planning, zoning, and construction/development; erosion and sediment control; floodplain management; water withdrawals and supply reservoirs; and storm water and wastewater discharges.

Benefits of Monitoring and Assessment – Identifying the limiting factors in the proper functioning of the creek/riparian area will significantly assist public agencies in assessing potential impacts to steelhead from proposed projects. Implementation of a long-term monitoring and assessment plan would produce more accurate and complete status and trends reports on the other special status species as well, and provide a better predictor of their future. Information could become part of the 305(b) assessment, engage residents in problem resolution, and lead to more cost-effective management of the watershed.

Appendix B. Current, Potential and Selected Historical Monitoring/Assessment Studies

Blank fields = no information

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
CURRENT STUDIES												
C1	D0201	Factors Affecting Distribution of Lotic Macroinvertebrates in an Urban Setting	USGS	Jim Carter et. al.	1997 - Fieldwork, 2000-2002 - Reporting	USGS, SCVURPPP		Relate the distribution of lotic macroinvertebrates to site- and basin-scale physical, chemical, and geomorphological variables. Determine how facts vary within and among subbasins and determine their rate of downstream change.	San Francisquito Creek, Corte Madera Creek, Los Trancos Creek	13 sites at approximately 2 km intervals from point of observed or assumed intermittent flow up to an altitude of 300-400 m		Bankfull stage, discharge, & width; Daily water depths; DO, Area of instream rearing & spawning habitat; Macroinvertebrate assemblage; Nitrate; Type, location, & coverage of riparian vegetation; Stream cover; Temperature
C2	D0213	USGS Website - Historical daily mean &/or peak flow	USGS		Continually updated			Daily mean &/or peak flows plus station #, long./lat., county, basin name at various monitoring stations.				Bankfull Stage, Discharge, & Width; Daily Flows, Velocities, & Depths
C5		Palo Alto Creeks Level Monitoring	City of Palo Alto	John Ballard	Continually updated	City of Palo Alto		Measure creek and tide levels, rain rate, and flood basin level to observe and record data about rain events and the effect on creek levels; and provide early flood warning information.	Water level monitoring.	San Francisquito Creek (2), and flood basin (1)	Pope/Chaucer, Waverly, and West Bayshore bridges	Creek levels at Chaucer, Waverly, and West Bayshore; Flood basin levels, Tide levels; Rainfall at Municipal Service Center and Foothills Park; Temperature
C9		Jasper Ridge Water Quality	Stanford	Cindy Wilber	Ongoing			Basic indicator monitoring.	Two locations above Searsville Lake, and one on San Francisquito Creek	San Francisquito Creek @ Searsville Dam		pH, DO, Temperature, Turbidity, Conductivity
C10		Study of fishes and amphibians of the San Francisquito Creek and Matadero Creek watersheds	Stanford	Alan Launer	Ongoing			Survey of native biotic diversity and assessment of whether Searsville Reservoir is a source of non-native species, whether non-native species pose a significant threat to native species, and whether effective methods of control of non-native species could be developed and implemented.	San Francisquito Creek from Searsville Dam to Los Trancos Creek, Los Trancos Creek downstream of Felt Lake diversion, and Bear Creek within Jasper Ridge Biological Preserve	Stanford University lands within San Francisquito Creek watershed including San Francisquito Creek from Searsville Dam to Los Trancos Creek, Los Trancos Creek downstream of Felt Lake diversion, and Bear Creek within Jasper Ridge	Series of points spaced approximately every 250 meters from Searsville Dam to provide spatial reference to survey data	Conventional field metering including: pH, DO, Temperature, Turbidity, Conductivity; Biotic surveys of fish, amphibians, reptiles, and tree locations; Physical data on pool and riffle locations
C11		Two separate reports – #1 - Streamflow Gains and Losses Along San Francisquito Creek, Estimated Ground-Water Recharge and Source of Ground-Water Recharge to Wells, Southern San Mateo and Northern Santa Clara Counties, California. #2 - Geohydrologic Framework and Simulated Ground-Water Budget for the Menlo Park Area, San Mateo County, California.	USGS	Loren Metzger	#1 - Fieldwork (1996-1997), report review (TBD); #2 - Report revision (TBD)			Estimate and characterization of ground-water recharge from San Francisquito Creek as part of a ground-water flow model of the Menlo Park area, and measurements of surface and ground-water quality.	San Francisquito Creek watershed	San Francisquito Creek alluvial fan (Menlo Park, East Palo Alto, Palo Alto, Atherton, Stanford	Not applicable	#1 - Series of seepage runs along the creek, estimated recharge from seepage to the underlying ground-water aquifer system, and water chemistry sampling from the creek and nearby wells. #2 - Model that covers the same general area – the San Francisquito Creek alluvial fan (Menlo Park, East Palo Alto, Palo Alto, Atherton, Stanford)

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CURRENT STUDIES												
C12		Water Quality and Streamflow Monitoring of the Bear Creek Watershed, Woodside, San Mateo County, California	SFWC	Balance Hydrologics	December 99-December 02	Packard Foundation, SCVURPPP	$199,563, $15,250	Evaluate whether pollutants discharged to Bear Creek adversely affect steelhead.	West Union Creek, Bear Gulch, Bear Creek, and Dry Creek	(9) West Union Creek @ Flood Estate, @ Kings Mountain, @ Adobe Corner; Bear Gulch @ Water Service Co. intake; Bear Creek @ Fox Hollow, @ Mountain Home, @Sand Hill Road; Dry Creek @ Olive Hill and @ Woodside Town Hall		Daily flow and stage hydrographs, Gauge height, Nitrate, Ammonia, TSS, Turbidity, Dissolved metals (Cd, Cu, Pb, Zn), Specific Conductance, Temperature, Diazinon, Chlorpyrifos (consider sampling for spikes either w/i this study or a follow-up study)
C13		West Union Creek Habitat and Fish Inventory	NPS-GGNRA	Darren Fong	July 96-November 99	NPS-GGNRA base funding		Inventory of stream habitat conditions and distribution and abundance of fish within Park boundaries.	West Union Creek	GGNRA lands downstream to Huddart Park near McGarvey Gulch confluence		Stream habitat classification, Juvenile fish surveys with e-fish and snorkel, Redd survey, Woody debris
C15		Data Report for Water Year 2001: Annual Hydrologic Record and Sediment Yield	Stanford University	Balance Hydrologics	2001	Stanford University		Stream flow and sediment transport monitoring on tributaries to Searsville Lake.	Corte Madera Creek, Searsville Lake, Sausal Creek, and Dennis Martin Creek			
C17		San Francisquito Creek Watershed Analysis and Sediment Reduction Plan	East Palo Alto, Menlo Park, Portola Valley, San Mateo County, Woodside, Palo Alto, SCVWD, and Santa Clara County	Cynthia D'Agosta	2001-	Proposition 13, JPA, Other matches	$313,900	Analyses leading to development of sediment reduction plans in accordance with NPDES storm water permit provision for San Mateo and Santa Clara county jurisdictions.	San Francisquito Creek watershed			
C18		"Storm drain mapping project"	RWQCB	SFEI	2000-2001	SWRCB		Create a GIS database for storm drain locations, networks and drainages in Alameda and Santa Clara Counties, Oakland, and San Jose.				National Hydrography Dataset (NHD) in ArcInfo coverage of 1:24,000 USGS Digital Line Graphs (DLG) with stream name and reach code attributes; storm drain locations (as points), networks, drainage areas (as polygons), land use, and ownership
C19		Searsville core sample analysis	Stanford University	USGS - Larry Phillips	To be completed in 2001			Analyses of sediment cores from Searsville Lake.	Searsville Lake	Two sites - the "Delta" site near the current inlet from Corte Madera Creek and the "Channel" site near the dam		Narrative description, photographs, continuous bulk density, pore space measurements, 137Cs, 210Pb, chlorinated herbicides, OC pesticides, OP pesticides, PCBs, and semivolatile organic compounds, trace metals, 13C, carbon

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CURRENT STUDIES												
C20	D0615	Joint Stormwater Agency Project to Study Urban Sources of Mercury and PCBs	SCVURPPP	Kinnetic Labs	October 00-	Bay Area storm water management programs		In cooperation with RWQCB and storm water programs, sample and analyze sediments for PCB and mercury concentrations in order to characterize typical urban concentrations from different land use areas (residential/commercial, industrial, transportation, open space).	San Francisquito Creek, Bear Creek, and McGarvey Gulch @ West Union Creek	Three sites - San Francisquito Creek @ Piers Lane; Bear Creek @ Woodside Road; and McGarvey Gulch @ West Union Creek		PCB congeners, total and methyl mercury, percent fines (< 63 microns), total organic carbon
C21		Bear Gulch District Water Quality Report	Cal Water		Annual			Information on drinking water quality testing, sources, and number of tests conducted each year.	Bear Gulch	Bear Gulch watershed		Gross alpha particle activity, Al, Ba, Cl, Color, Cu, Fl, Hardness, Pb, Odor, Na, Specific conductance, Sulfate, TDS, Aldehydes, Chloropicrin, Haloacetic acids, Haloacetonitriles, Haloketones, Total organic halides (TOX), Total trihalomethanes (TTHMs), Turbidity
C24		Development of GIS and maps for San Francisquito Creek watershed	USGS/SFWC	Trish Mulvey/ Alicia Torregrosa/ Robb Kapla	Preliminary compilation - 12/00; Update w/ ABAG 2000 land use data	In-kind	N/A	Provide assistance in developing an information management system (including GIS and maps) for the San Francisquito Creek watershed that: 1) includes a link to the SCBWMI public access data repository, and 2) is as consistent as possible with similar systems being developed by the Regional and State Board.	San Francisquito Creek watershed	Not applicable	Not applicable	Parameters that may be provided via Potential Study #9 (i.e., P9) plus others: Land area/watershed delineation; Land use types; Development history; Population; Schools/Educational institutions; Municipal resources; Community resources and organizations; Local media outlets; Creek characteristics; Natural and ecological history
C25		Genetic Relationships Among Steelhead Rainbow Trout Populations in Tributaries to South San Francisco Bay (Phase I)	SJSU	Warren Hankinson / Jerry Smith	Winter 2002	SCVWD		Determine genetic relationships among different populations of South San Francisco Bay and Central California Coast steelhead/rainbow trout and the relative influence of hatchery stocking on population genetics.	San Francisquito Creek, Los Trancos Creek	Los Trancos Creek @ Felt Lake Diversion, San Francisquito Creek @ Piers Lane		Fin clips for 20-40 steelhead at each location, Single primer (GTGx5) Randomly Amplified Polymorphic DNA (RAPD) genetic analysis
C26		A Comprehensive Groundwater Protection Evaluation for South San Francisco Bay Basins	RWQCB	Greg Bartow	June 2000-2002			Evaluation of existing, planned and probable beneficial uses and review of existing groundwater protection strategies including organization of groundwater contamination and beneficial use information in a GIS format.	San Mateo Plain Ground Water Basin, Santa Clara Valley	Not applicable	Not applicable	Basin boundaries; Existing, municipal, industrial, and agricultural wells; Magnitude and extent of historical groundwater use; Occurrence and threat from recalcitrant compounds from contamination sites, and threats from vertical conduits and sewer lines; Mapping of recharge and discharge areas, and vertical gradients
C27		Genetic Relationships Among Steelhead Rainbow Trout Populations in Tributaries to South San Francisco Bay (Phase II)	SJSU	Jerry Smith / Adam Genar	Fall 2001	SCVWD		Determine genetic relationships among different populations of South San Francisco Bay and Central California Coast steelhead/rainbow trout and the relative influence of hatchery stocking on population genetics.	San Francisquito Creek	San Francisquito Creek @ Piers Lane		Genetic analyses using five microsatellite DNA markers

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CURRENT STUDIES												
C28		Stream Flow Hazards Evaluation - 2001 Lower Corte Madera Creek	Portola Valley	Cotton, Shires & Associates	Winter-Summer 2001	Portola Valley	$15,000	Update the 1984 study (H25) - Preliminary Assessment of Corte Madera Creek - to check performance of structures.	Corte Madera Creek	Corte Madera Creek from Willowbrook Dr. d/s to town boundary	Not applicable	100-scale engineering geologic mapping, photo survey, engineering geologic analysis of creek condition and existing channel modifications
C29		Long-term Water Quality Monitoring	City of Palo Alto, Stanford University, San Francisquito Watershed Council	Geoff Brosseau	2001-	City of Palo Alto, Stanford University	Long-term monitor-ing of water	quality at fixed stations to characterize wet season conditions.	San Francisquito Creek and Los Trancos Creek	Three sites - San Francisquito Creek @ Newell, @ Piers Lane; Los Trancos Creek @ Piers Lane		Dissolved/total metals - Al, Cu, Pb, Hg, Ni, Se, Ag, Zn; Hardness; TSS; Nitrate; Ammonia; Phosphorous; Diazinon & Chlorpyrifos; Field parameters - pH, DO, Temperature, Conductivity, estimated Flow rate; Field observations / Newell station only add - As, OC pesticides (Chlordane/Dieldrin/DDT); PCBs/ Dioxins/Furans; Macroinvertebrates
C30 (P1)		The Creek Project: An integrated study of an urbanized water-shed, San Francisquito Creek, CA	USGS	Herman Karl	2001-	USGS		Investigation of erosion and sediment transport processes within the headwater areas of the watershed, and development of a model linking changes in land use to changes in sediment supply. The project's simulation modeling will concentrate on watershed hydrology, particularly on over-land flow resulting from a storm event, rather than on channelized flow within the stream system. An investigation is being conducted of sediment erosion and depo-sition occurring in the tidal influenced reaches of the creek. The principal objective of this study is to identify and delineate past flood events.	San Francisquito Creek watershed	Upper watershed and tidally influenced reaches; Sediment cores - Transect of post-1930 delta from high upper tidal to lower tidal and pre-1930 to circa 1500 tidal delta	Not applicable	Watershed land use/landscape change - rainfall, synthetic daily discharge hydro-graphs, sediment discharge volume estimates, vegetation cover, land use, annual evapotranspiration change and soil erosion rate change models; Modeling of downstream sediment transport; Sediment cores - 210Pb and 14C dating, introduced microfauna and macrofauna, sediment textural and carbon studies, diatom census studies, pesticides
C31		The Creek Project: Computer-based Decision Support System	USGS	Herman Karl/ Kathi Beratan	2001 -	USGS		Explore the role of science, scientists, and scientific analysis in negotiations regard-ing the management of environmental resources. An educational component will focus on working with school groups to test, evaluate, and learn from communi-ties' experiences with using science in col-laborative processes to resolve environ-mental issues. The educational element is designed to (1) raise community aware-ness of environmental problems within the watershed and (2) actively engage the community in the decision-making process. During the first year (March 1 to October 1, 2001), project team members will design training materials for teachers, develop an exhibit for the USGS Western Region Visitor Center, and interview stake-holder groups.	San Francisquito Creek watershed	Not applicable	Not applicable	

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CURRENT STUDIES												
C32 (P18)		Known Barriers / Impediments to Upstream Migrating Adult Steelhead	Steelhead Technical Task Force - San Francisquito Watershed Council	Matt Stoecker	2000-2001			Listing of barriers and impediments to migrating adult steelhead in the San Francisquito Creek, Los Trancos Creek, Bear Creek, and Searsville watersheds.	San Francisquito Creek, Los Trancos Creek, E. Los Trancos Creek, Bear Creek, Bear Gulch, West Union Creek, McGarvey Gulch, Corte Madera Creek, Dennis Martin Creek	More than 25 sites	Too numerous to list	Creek, name/barrier type, location, owner, severity, priority, notes and possible actions
C33		Central California Coast Recovery Planning Tool - Landscape Characterization and Restoration	National Marine Fisheries Service, State of California	Circuit Rider Productions	2001-2003	NOAA Coastal Services Center		Production of a digital information resource for use in developing a recovery plan for salmon and steelhead that are listed as threatened under the Endangered Species Act by assembling all relevant and available spatial and non-spatial data necessary to support assessment and decision-making by natural resource managers to plan for and implement actions leading to the recovery of listed salmonids.	San Francisquito Creek Watershed	Not applicable	Not applicable	Timber harvest; agricultural impacts; urban growth; long-term management plans; environmental conservation and restoration activities; habitat conditions and limiting factors; salmonid population presence, abundance, and distribution; historical habitat trends; thematic mapping

Appendix B. Current, Potential and Selected Historical Monitoring/Assessment Studies

Blank fields = no information

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
POTENTIAL STUDIES												
P2		Searsville dam removal feasibility study						If the results of the Searsville Lake Sediment Impact Study H34 (C16) indicate that the downstream environment can tolerate the addition of upstream sediment load, a subsequent study will be requested from state or federal funds to study the feasibility of complete removal of the dam.				(include impacts to base flow below dam)
P3		Existing conditions report for bank stabilization and revegetation master plan - upper watershed						Repeat study H32 (C14) - Existing Conditions Report for Bank Stabilization and Revegetation Master Plan - for the upper watershed		Study area could be top-of-bank to top-of-bank for major creeks and tributaries with existing or planned development upstream of Junipero Serra Blvd.		
P4		Extent and impact of mitten crab invasion on bank stability and sediment loads						Identify areas invaded by mitten crabs and assess their impacts to bank stability and sediment loads	San Francisquito Creek and tributaries as determined in the field			
P5		Habitat evaluation for beneficial use and listed species protection						Evaluate habitat quality in relation to habitat needs for beneficial use and listed species protection	San Francisquito Creek watershed			
P6		Mapping creek and watershed - Palo Alto and vicinity	San Francisquito Watershed COuncil	Oakland Museum of California, William Lettis Assoc.	2002-2004	CalFed	$55,320	Research, produce, and distribute an approximately 1:26,000 scale map of the surface water hydrology of the Palo Alto/ San Francisquito Creek area		East Palo Alto, Menlo Park, Palo Alto; Portions of Portola Valley and Woodside		Historical and present-day creeks, engineered channels, storm drains, marshes, shorelines, and jurisdictions
P7		Assessment of land use change impacts to sediment loads						Relate current sediment data to historic data and land use changes				
P8		Comparison of development policies - rest of San Mateo jurisdictions						Repeat study H13 for the jurisdictions on north side of the county line not covered by H13 (i.e., East Palo Alto, Portola Valley, Woodside, and San Mateo County)				Eight types of policies - erosion and sediment control, post-construction BMPs, storm water pollution, drainage, wetlands/riparian protection, imperviousness, open space, and auto use/transportation
P9		Community characteristics and demographics	SFWC/USGS	Trish Mulvey/ Alicia Torregrosa	Preliminary compilation - 12/00; Update w/ 2000 US census	In-kind	N/A	Compile social inventory based on templates from the Santa Clara Valley Urban Runoff Pollution Prevention Program's draft community characteristics and resources matrix (3/96) and social indicators from the SFEI Watershed Science Approach (9/98)	San Francisquito Creek watershed and associated municipalities	Not applicable	Not applicable	Parameters that will be used in study C24 including: Land area/watershed delineation; Land use types; Development history; Population; Schools/Educational institutions; Municipal resources; Community resources and organizations; Local media outlets; Creek characteristics
P10		Water Management in Pilot Watersheds						Complement WMI Watershed Assessment by describing how water suppliers and water users modify the natural flow of water in the watershed				Water rights, well permits

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POTENTIAL STUDIES												
P11		Follow-up evaluation of the sources of sediment						Follow-up study of sediment sources identified in study H29 (C7), and evaluation of sediment sources in other creeks not covered by study H29 (C7) (e.g., West Union Creek)				
P12		Willingness to pay survey						Survey local residents about watershed issues and their willingness to pay to address them				
P13		Identification and assessment of hydrology relative to habitat needs						Conduct study similar to studies C10 and H6 - measuring and assessing habitat conditions, particularly locations, levels, and quality of water, relative to habitat needs for key species	San Francisquito Creek below 280, Los Trancos Creek, Corte Madera Creek, and Bear Creek			
P14		Fish and fish habitat surveys						Repeat study similar to studies C10 (Stanford lands) and C13 (West Union Creek) in other tributaries	San Francisquito Creek, Los Trancos Creek, Searsville Lake tributaries, Bear Creek tributaries			
P15		Long-term monitoring of upper subwatersheds						Initiate long-term monitoring sites (similar to those in study C29) at the base of the Searsville Lake, Bear Creek, and Corte Madera Creek watersheds	San Francisquito Creek, Bear Creek, Corte Madera Creek	San Francisquito Creek @ Searsville Dam, Bear Creek @ Sand Hill Road, Corte Madera Creek @ Westridge Road		Consistent with C29 (3 lower watershed sites)
P16		Evaluation of pollutant impacts on aquatic life uses						Monitoring toxicity of water quality samples. Compare diazinon concentrations to water and sediment quality criteria	San Francisquito Creek watershed			
P17		Factors affecting distribution of lotic macroinvertebrates in the Bear Creek watershed						Repeat study C1 in the Bear Creek watershed	Bear Creek and tributaries			
P19		Determination and comparison of genetic populations of fish in Los Trancos and Searsville Lake watersheds						Repeat study similar to studies H17 and C25 on fish in the Los Trancos Creek watershed and Searsville Lake and its watershed	Los Trancos Creek and tributaries, Searsville Lake and tributaries			
P20		Identification and evaluation of impacted habitats and population and community structures						Repeat study similar to study C10 on non-Stanford lands				
P21		Identification and evaluation of toxic effects and sources						As follow-up to P15 and modified C29, conduct Toxicity Identification Evaluations (TIEs), when appropriate				

Blank fields = no information

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
POTENTIAL STUDIES												
P22		Presence of indicators of human health impacts						Collect and analyze water samples for indicators of human health impacts				
P23		Identification of potential causes/ sources of pathogen exposure and effects						Follow-up to P22, when appropriate				
P24		San Francisquito Creek water-shed residents survey						Survey opinions, concerns, desires, and activities of residents regarding the water-shed, its resources, and uses				
P25		Inventory of current human impacts						Document human impacts including litter, homeless encampments, illegal discharges, and recreation				
P26		Storm drain outfall sampling						Monitor flows from selected storm drain outfalls to determine their contributions to San Francisquito Creek	San Francisquito Creek, Los Trancos Creek, Corte Madera Creek, Bear Creek	To be determined based on field observations and other studies		
P27		Historical ecology						Documentation of environmental change through time	San Francisquito Creek watershed	Not applicable	Not applicable	Native landscape and intermediate stages from 1770s to present
P28		Barrier retrofit/removal study						Follow-up studies H30 (C8) and C32 on priority barriers that need study before retrofit or removal	San Francisquito Creek watershed			
P29		Feasibility study - Removal of north levee through wetlands						Study the feasibility of removing the levee on the north side of San Francisquito Creek after it makes its last turn toward the east and empties into San Francisco Bay. Levee artificially separates creek from wetlands to north. Removal may create a functional estuary that would potentially improve habitat conditions for steelhead and other species as well as improving the flow of water to the Bay and decrease upstream flooding.	San Francisquito Creek	North levee on final reach		
P30		Riparian habitat survey - upper watersheds						Repeat study H23 for Los Trancos Creek, Bear Creek, and Searsville Lake watersheds	Los Trancos Creek, Bear Creek, and Searsville Lake watersheds	Not applicable	Not applicable	Terrestrial habitat types; Habitat suit-ability values (Wildlife Habitat Relationships system)
P31		Post-project monitoring for bank stabilization and revegetation Master Plan projects	JPA					Post-project monitoring of project(s) identified in study H32 (C14) and overseen by a Local Project Oversight Body.	San Francisquito Creek	Study area is top-of-bank to top-of-bank for 6.5 miles from Junipero Serra Blvd. to Highway 101.		
P32		Trash survey and characterization						Survey and characterize the spatial and temporal extent of trash	San Francisquito Creek and major tributaries	Riparian corridor	Not applicable	Location, Date, Type, Amount (volume, area, or weight), Condition (floating, buried, caught in vegetation, loose), Likely source

Appendix B. Current, Potential and Selected Historical Monitoring/Assessment Studies

Blank fields = no information

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
HISTORICAL STUDIES (SELECTED)												
H1	D0101	San Francisquito Creek Pilot Volunteer Monitoring Project	CRMP	CCRS	1992-1995	USEPA / SCVWD		Collect data on basic water chemistry parameters, characterize streamside vegetation, systematically observe birds, survey reptile and amphibian populations, classify instream fisheries habitat, and collect stream channel profiles.	San Francisquito Creek	41 sites located every 500 m upstream from the mouth to Searsville Dam		Water quality - Temperature, DO, turbidity, pH, conductivity, nitrates, nitrites, ammonia, orthophosphates; Birds - Distribution, abundance, and diversity; Vegetation - Distribution, abundance, percent cover, percent native/non-native; Reptiles/amphibians - Distribution and abundance; Fisheries habitat - habitat type and substrate size classes
H2	D0554	Assessment of San Francisquito Creek	Stanford Linear Accelerator Center (SLAC)	Converse Environmental	1992	SLAC		Evaluate whether environmental releases of contaminants have affected soil and water quality in San Francisquito Creek.	San Francisquito Creek	40 sampling points on 3-mile stretch between Searsville Dam and Los Trancos Creek. Sediment samples from 32 sites along creek and 8 sites in drainage channels upstream of creek. Water samples from seven points along creek and one from PVTC drainage pool.		Primarily PCBs and Pb; Selected samples also analyzed for Ag, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mb, Ni, Pb, Sb, Se, Tl, V, Zn, total recoverable petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, semi-volatile organics, OC pesticides, total phosphorous, orthophosphate, and nitrate. Background soil samples (10 @ SLAC and 5 @ JRBP) analyzed for metals.
H3	D0003	Historical Fishery Studies conducted on several Santa Clara Basin creeks	USEPA	Rob Leidy	1992-1998	USEPA		Fish assemblages	San Francisquito, Corte Madera, and Los Trancos Creeks	(5) Corte Madera Creek @ Westridge Road; Los Trancos Creek @ San Francisquito Creek; San Francisquito Creek @ Sand Hill Road, @ Piers Lane		Species number, type, percent native, and ratings; Fork or Tail length
H4		Geohydrologic Framework, Historical Development of the Ground-Water System, and General Hydrologic and Water-Quality Conditions in 1990, South San Francisco Bay and Peninsula Area, California	USGS and Bay Area Water Users Association (BAWUA)	John Fio	1995	USGS		Existing data used for a regional assessment of geohydrologic and water quality conditions in the South San Francisco Bay and Peninsula area.	San Francisquito Creek watershed, South San Francisco Bay and Peninsula Area	Watershed-wide study	Not applicable	Maps of wells and boreholes, surficial geology, thickness of alluvium, boundaries of regional physiographic areas, fraction of coarse-grained sediment, altitude of well water levels (early 1900s), hydraulic head surface, total subsidence, chloride ion concentrations, high TDS areas, production wells, and wells with high nitrate concentrations. Transmissivity and fraction of coarse-grained sediment, estimated groundwater storage capacity of sediments, and reported well pumpage (1990).

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NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
HISTORICAL STUDIES (SELECTED)												
H5	D0555	Sedimentation and Channel Dynamics of the Searsville Lake Watershed and Jasper Ridge Biological Preserve, San Mateo County, California	Stanford	Balance Hydrologics	1995-1996	Stanford		Hydrologic study to assess sedimentation of Searsville Lake and tributary streams in the Jasper Ridge Biological Preserve and vicinity.	Searsville Lake, Corte Madera Creek, Sausal Creek, Dennis Martin Creek	Bathymetric survey - Searsville Lake; Level survey - lowermost Corte Madera Creek; Storm period stream gauging and sediment transport sampling - Corte Madera Creek @ Westridge Road; Sedimentation rate assessment estimates - Searsville Lake; Recon. erosion assessment - Corte Madera Creek		Bathymetric survey; Level survey; Storm period stream gauging and sediment transport sampling; Sedimentation rate assessment estimates; Recon. erosion assessment
H6		San Francisquito Creek Upper Watershed Volunteer Monitoring Project	CRMP	CCRS/Balance Hydrologics	1997-1998	USEPA 319(h)	$144,000	Volunteer monitoring of sediment and water quality of seven sites on San Francisquito Creek and its tributaries.	San Francisquito, Corte Madera, Los Trancos, Bear,and West Union Creeks	(7) West Union Creek @ Squealer Gulch & Greer Road, Bear Creek @ Sand Hill Road, Corte Madera Creek @ Westridge Road, Los Trancos Creek @ Piers Lane, San Francisquito Creek @ USGS gauge (Stanford University), @ Searsville Dam, and @ Piers Lane	37° 26' 14"/122° 16' 58"; 37° 24' 40"/122° 14' 24"; 37° 23' 00"/122° 13' 18"; 37° 24' 48"/122° 11' 28"; 37° 25' 25"/122° 11' 19"; 37° 24' 30"/122° 14' 15"; 37° 24' 49"/122° 11' 30"	Air and water temperature variation, pH, conductivity, DO, turbidity, suspended sediment, stream flow, pebble counts, height of streambank and water, Thalweg profile
H7	D0556	Sampling and Analysis of Water from the San Francisquito Creek Watershed	CRMP/Palo Alto	Mike Rigney and Jim Johnson	1997-1998			Water quality monitoring of seven sites on San Francisquito Creek and its major tributaries through one winter and spring.	San Francisquito, Corte Madera, Los Trancos, Bear, and West Union Creeks	(7) West Union Creek @ Squealer Gulch & Greer Road, Bear Creek @ Sand Hill Road, Corte Madera Creek @ Westridge Road, Los Trancos Creek @ Piers Lane, San Francisquito Creek @ USGS gauge (Stanford University), @ Searsville Dam, and @ Piers Lane	37° 26' 14"/122° 16' 58"; 37° 24' 40"/122° 14' 24"; 37° 23' 00"/122° 13' 18"; 37° 24' 48"/122° 11' 28"; 37° 25' 25"/122° 11' 19"; 37° 24' 30"/122° 14' 15"; 37° 24' 49"/122o 11' 30"	Heavy metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn); Pesticides (diazinon & chlorpyrifos); Ammonia, Nitrate, Orthophosphate
H8	D0553	Impervious Cover As a Watershed Management Tool for San Mateo County Watersheds	STOPPP	EOA	1998	STOPPP		Estimate impervious cover and demonstrate use of impervious cover as a tool for urban watershed management.	San Francisquito Creek watershed	Watershed-wide study	Not applicable	Land uses by area, percentage of watershed area, and estimated percent impervious cover (0, 30, 45, 60, 65, 70, 95, 100%); Map of estimated percent impervious cover (0, 30, 45, 60, 65, 70, 95, 100%)

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
HISTORICAL STUDIES (SELECTED)												
H9		Watershed Characteristics Report	SCBWMI	EOA, URS, LWA, RRM Design Group, Habitat Restoration Group, Balance Hydrologics	2000	SCVWD, SCVURPPP, Palo Alto, San Jose, Sunnyvale		The report describes the general physical and political characteristics of the Santa Clara Basin, including land use, regulatory aspects, and water management facilities	San Francisquito Creek watershed	Basin-wide report	Not applicable	Political and watershed boundaries; Cultural - population, housing, and labor statistics, and patterns of urbanization; Land use - existing and projected land uses, hydrologic features and riparian corridors; Regulatory - laws, regulations, and permits, agency information, wetland definitions; Natural - beneficial uses and watershed maps; Water management - reservoir and channel characteristics, facilities, flood-prone areas, and water balance diagram
H10		"Sharon creek study"	USGS									
H11		Existing Land Use in 1995: Data for Bay Area Counties and Cities	ABAG		1995	ABAG		Detailed land use classifications in ARCINFO format at 200 meter resolution				
H12		Creekside Corridor Committee Report to the Town of Council	Portola Valley	Leslie Lambert	2000			Review of the town's general plan, zoning ordinance, site development ordinance, subdivision ordinance, emergency stabilization projects, and recommendations on formulation of riparian buffer zones and conservation easement dedications along riparian corridors	Los Trancos Creek, Corte Madera Creek, and Sausal Creek	Creek corridors	Not applicable	Narrative descriptions of existing conditions and usefulness of: maps as well as the general plan, zoning ordinance, site development ordinance, and subdivision ordinance in helping the town address concerns regarding creeks
H13		Comparison of Development Policies - Draft	SCBWMI	EOA	1999			Describes how the land use policies of some of the governmental entities in the Santa Clara Basin compare to each other, and to selected example or model policies from municipalities outside the Basin, in providing for watershed protection or enhancement	Selected jurisdictions in San Francisquito Creek watershed (i.e., Palo Alto, Menlo Park, Santa Clara County, SCVWD)		Not applicable	Eight types of policies - erosion and sediment control, post-construction BMPs, storm water pollution, drainage, wetlands/riparian protection, imperviousness, open space, and auto use/transportation
H14		"Public survey"	SCVURPPP	Fairbank, Maslin, Maullin & Assoc.	1999			Survey of general behaviors and attitudes towards environmental issues as well as awareness of and attitudes towards storm drain issues and watersheds	Santa Clara County portions of watershed	Not applicable	Not applicable	Pollution, Bay pollution, responsibility of residents, sources of pollution, important natural features, do-it-yourself activities, information/news sources, pollution prevention behaviors, mechanism for and receptiveness to messages, understanding of storm drain systems and pollutants, understanding of watersheds
H15		Reconnaissance Investigation Report of San Francisquito Creek	CRMP		1998			Historical summary of floodplain management proposals that have been made for the San Francisquito Creek watershed				Brief descriptions of previously considered alternatives, feasibility assessments, impacts, and preliminary cost estimates

Blank fields = no information

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HISTORICAL STUDIES (SELECTED)												
H16		Ground-Water Development and the Effects on Ground-Water Levels and Water Quality in the Town of Atherton, San Mateo County, California	USGS and Town of Atherton	Loren Metzger	1997	USGS		Study done within the San Francisquito cone of the effects of pumping on ground-water levels and quality	Not applicable	Wells in Atherton	Not applicable	Recorded pumpage, recorded operation time, and measured pumpage rates from 38 wells; water levels from 49 wells; water chemistry samples from 20 wells, and land-surface elevation data from 22 survey sites; geolithic, lithologic, climato-logic, well construction, well location
H17	D0616	Microsatellite Analyses of San Francisquito Creek Rainbow Trout	Stanford University	Jennifer Nielsen	2000			Examination of genetic diversity from rain-bow trout in San Francisquito Creek, and comparison with the genetic diversity found in trout and steelhead populations throughout California	San Francisquito Creek			Analyses of mitochondrial DNA and 10 microsatellite loci amplified from DNA extracted from rainbow trout tissues collected from San Francisquito Creek
H18		The Hydrogeology of the San Francisquito Creek Basin, San Mateo and Santa Clara Counties, California	Stanford University	Daniel Sokol	1964			Determine the relationship between groundwater conditions and geologic fea-tures within the drainage basin and the alluvial fan of San Francisquito Creek and evaluate the groundwater potential of diverse parts of the basin	San Francisquito Creek Watershed	Basin-wide report	Not applicable	Geography - physiography, climate, soils, vegetation, land use, water requirements and use; Geology - stratigraphy, structural geology, geo-morphology, history; Hydrology - precip-itation, evapotranspiration, surface retention, infiltration, soil moisture, streamflow, impounded water, ground-water flow, hydrologic budget; Groundwater - aquifers, water levels, fluctuations; Hydrogeologic subareas; Geologic map of basin
H19		FEMA Maps										
H20		After the Flood Waters Receded: Assessing the Economic Impacts of San Francisquito Creek's February 1998 Flooding	US Army COE and SCVWD	Katherine Kao Cushing	1999			Identify and quantify the main economic impacts of the February 3, 1998 flooding on residents, businesses and organizations, and municipalities in East Palo Alto, Menlo Park, and Palo Alto. Maps showing approx-imate extent of flooding also included.	San Francisquito Creek	Lower watershed-wide study	Not applicable	Phone and mail surveys, interviews, and document review
H21		Fish surveys (29)	CDFG		1974-1996				San Francisquito Creek, Los Trancos Creek, West Union Creek, Bear Creek			Surveys of fish assemblages plus (depending on the study) macroinverte-brate assemblages, instream spawning & rearing habitat, physical barriers, riparian vegetation, temperature, chan-nel substrate, daily flows & velocities, turbidity, stream cover, altered channel materials & dimensions, type of recre-ational activities, special status species abundance & distribution

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HISTORICAL STUDIES (SELECTED)												
H22		Inspection of San Francisquito Creek	Manzanita Water Company	Allardt and Grunsky	1888			Report of August 1888 field inspection of San Francisquito Creek from the area around Highway 280 (original proposed dam site) to the Bay with detailed narrative descriptions interspersed with quantitative information	San Francisquito Creek	Not applicable	Not applicable	Narrative field observations; Flow; Locations of pools/springs; Bank heights; Creek widths
H23	D0104	San Francisquito Creek Riparian Habitat Project Report	STOPPP	CCRS	1999	STOPPP		Data and maps characterizing riparian quality on both banks of San Francisquito Creek from the Bay to Searsville Dam	San Francisquito Creek	Not applicable	Not applicable	Terrestrial habitat types; Habitat suitability values (Wildlife Habitat Relationships system)
H24		Geologic, Geotechnical Engineering, Seismologic and Hydrologic Investigations - Estate Development Feasibility	Octopus Holdings	Applied Earth Sciences Consultants	1996			Geologic, geotechnical engineering, seismologic, and hydrologic investigations in preparation for redevelopment of 23.4 acre estate at 745 Mountain Home Road, Woodside including construction and filling of 2.3 acre main pond and 0.46 acre secondary pond by drawing 24.5 AF per year from on-site wells	Bear Creek watershed	Not applicable	Not applicable	Site geomorphology, soil, sediments, bedrock, faults, surface and subsurface water, soil percolation, groundwater depths, pump yields
H25		Preliminary Assessment of Corte Madera Creek	Portola Valley	William Cotton & Associates	1984			Visual inspection of developed portion of Corte Madera Creek to characterize existing conditions and provide recommendations to reduce flooding risks	Corte Madera Creek			
H26		Flatland Deposits of the San Francisco Bay Region, California —Their Geology and Engineering Properties and Their Importance to Comprehensive Planning (Geological Survey Professional Paper 943)	USGS	E.J. Helley and K.R. LaJoie (USGS) & W.E. Spangle and M.L. Blair (William Spangle & Assoc.)	1979			Report on flatland deposits and their land use significance including an identification of the different kinds of deposits that underlie flatlands of the bay region and a description of their properties and the processes that formed them.	San Francisquito Creek	Not applicable	Not applicable	Geologic history and maps; physical and seismic properties; water-related problems and seismic hazards in flatland areas
H27 (C4)	D0233	Palo Alto Stream Monitoring	City of Palo Alto		1992-1998			Wet weather monitoring of local creeks	San Francisquito Creek and Los Trancos Creek	San Francisquito Creek @ Newell; Los Trancos @ Felt Lake diversion		Cu, Ni, Pb, Zn, Total & Dissolved Solids, Nitrates, Turbidity, DO, pH, Conductivity

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
HISTORICAL STUDIES (SELECTED)												
H28 (C6)	D0612	Assessment of Water Quality in Urban and Rural Stormwater Runoff	CCRS	Kristen Sipes	2000	San Mateo County	$5,067	Compare pollutants in stormwater runoff discharged in urban and rural areas of the watershed.	San Francisquito Creek	(14) Storm drain outfalls - 1837 Woodland Ave.; Woodland Ave. at Newell Ave.; Palo Alto Ave. at Everett; Palo Alto Ave. at Alma; Stanford Mall; Sand Hill Rd. at Oak Creek Apts.; Sand Hill Rd. bridge; Alpine Rd. at fruit stand; PVTC first one by rink; PVTC under 280 overpass; Boething Tree Farm #1; Boething Tree Farm #2; Sand Hill Rd. at Whiskey Hill Rd.; Jasper Ridge Reference Site	37.454287/122.131661; 37.454484/122.135281; 37.453586/122.157156; 37.447037/122.168064; 37.446154/122.171241; 37.430108/122.188858; 37.428933/122.188937; 37.412602/122.193048; 37.411871/122.197672; 37.411052/122.19832; 37.407234/122.211824; 37.40714/122.21249; 37.411417/122.239818; 37.407332/122.238138	Ammonia, Nitrate, Nitrite, Orthophosphate, Diazinon, Chlorpyrifos
H29 (C7)	D0614	Geomorphic study of Searsville Lake watershed, Portola Valley, CA	SJSU	Caroline Frey	2001			Mapping geomorphic condition of creeks including bank erosion, landslides, sediment deposits, and quantitative classification.	Searsville Lake watershed	Most all tributaries to Searsville Lake including: Corte Madera Creek, Sausal Creek and their tributaries	Not applicable	
H30 (C8)	D0617	Adult Steelhead Passage in the Bear Creek Watershed	SFWC	Jerry Smith and Deborah Harden	2001	Department of Fish & Game	$35,638	Systematically map and assess barriers to steelhead trout migration, develop plans to improve barriers, and set priorities for barrier modification.	Bear Creek, Bear Gulch, West Union Creek, Squealer Gulch, and McGarvey Gulch	Bear Creek, Bear Gulch, West Union Creek, Squealer Gulch, and McGarvey Gulch	Not applicable	Migration barriers including Location, Description, Ownership, Obstruction type, Dimensions, Condition, Impact on channel morphology and fishery, and Amount and Type of trapped sediment
H31 (C10)	D0618	Two separate reports - #1 - Biotic Resources of the San Francisquito Creek Watershed: Report on 1997 Field Activities Associated with Streambed Alteration Agreement #934-96. #2 - Fishes and Amphibians of the San Francisquito Creek and Matadero Creek Watersheds, Stanford University: Report on 1998 & 1999 Field Activities.	Stanford	Alan Launer et. al.	1998 and 2000			Survey of native biotic diversity and assessment of whether Searsville Reservoir is a source of non-native species, whether non-native species pose a significant threat to native species, and whether effective methods of control of non-native species could be developed and implemented.	San Francisquito Creek from Searsville Dam to Stanford Golf Course, Los Trancos Creek downstream of Felt Lake diversion, and Bear Creek within Jasper Ridge Biological Preserve	Stanford University lands within San Francisquito Creek watershed including San Francisquito Creek from Searsville Dam to Stanford Golf Course, Los Trancos Creek downstream of Felt Lake diversion, and Bear Creek within Jasper Ridge	Series of points spaced approximately every 250 meters from Searsville Dam to provide spatial reference to survey data	Conventional field metering including: pH, DO, Temperature, Turbidity, Conductivity; Biotic surveys of fish, amphibians, reptiles, and tree locations; Physical data on pool and riffle locations
H32 (C14)	D0620	Two separate reports - #1 - San Francisquito Creek Existing Conditions Report; #2 - San Francisquito Creek Bank Stabilization and Revegetation Master Plan	Menlo Park, Palo Alto, East Palo Alto, San Mateo Co. FCD, and SCVWD	Dianne Dryer	2000	Menlo Park, Palo Alto, East Palo Alto, San Mateo Co. FCD, and SCVWD		Existing Conditions Report lays groundwork for Bank Stabilization and Revegetation Master Plan by documenting conditions in creek corridor between August 1998 and January 1999. The Master Plan is intended to assist agencies and land owners' consultants in planning, conceptual design, and permitting of San Francisquito Creek stabilization and revegetation projects.	San Francisquito Creek	Study area is top-of-bank to top-of-bank for 6.5 miles from Junipero Serra Blvd. to Highway 101.	Not applicable	Survey and base maps; geomorphic maps, summary of physical and channel bank conditions; Existing vegetation and extent of canopy maps; Summary of endangered species information; Summary of cultural/historical information

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
HISTORICAL STUDIES (SELECTED)												
H33 (C15)		Three separate reports - #1-WY1997 hydrologic report for Corte Madera Creek. #2-Annual Hydrologic Record and Preliminary Sediment Budget: Searsville Lake and its Tributaries, San Mateo County, California, Data Report for Water Year 1998. #3-Data Report for Water Year 1999: Annual Hydrologic Record and Sediment Yield, Corte Madera Creek, Portola Valley, California, with Occasional Observations on Sausal and Dennis Martin Creeks, Woodside, California	Stanford University	Balance Hydrologics	1998, 1999, and 2000	Stanford University		Stream flow and sediment transport monitoring on tributaries to Searsville Lake.	Corte Madera Creek, Searsville Lake, Sausal Creek, and Dennis Martin Creek			
H34 (C16)	D0602	Searsville Lake Sediment Impact Study	Stanford University	Northwest Hydraulic Consultants, Balance Hydrologics, H.T. Harvey Assoc.	2002	Stanford University		Study of the sediment impacts downstream of Searsville Lake including an analysis of existing conditions, analysis of future conditions given no intervention, and analysis of conditions given certain potential modifications to Searsville Dam.	Searsville Lake watershed including the five creeks that feed the lake: Corte Madera Creek, Westridge Creek, Sausal Creek, Dennis Martin Creek, and Alambique Creek, plus San Francisquito Creek downstream of Searsville Dam	Not applicable	Not applicable	Existing conditions including: limited topographic surveys, geomorphic conditions (San Francisquito Creek), synthesis map and report of existing biological/habitat information, bathymetric survey (Searsville Lake), and analysis of previously collected sediment cores; refined projections for life of the lake and expected changes to San Francisquito Creek after lake fills-in; identification of differential impacts between dam-lowering versus natural filling-in scenarios
H35 (C22)		Topographic survey and hydraulic modeling	SCVWD	Sara Duckler	2001			Topographic survey of San Francisquito Creek from San Francisco Bay to the 280 freeway. A one-dimensional (HEC-RAS) hydraulic model was also developed for this section of the creek.	San Francisquito Creek	Highway 280 to San Francisco Bay	Not applicable	
H36 (C23)		Defining Watershed Delineations, Task 2: Identify Areas with Outdated Drainage Information	SCBWMI	Paul Randall - EOA	2001			Provide the SCBWMI Core Group with supporting information to make a decision on the watershed boundaries to be used by the SCBWMI.	San Francisquito Creek watershed	Not applicable	Not applicable	Boundary data sets, Storm drain system maps

NO.	WMI METADATA RECORD	STUDY NAME	SPONSOR	CONTRACTORS OR CONTACT	SCHEDULE	FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION	TRIBUTARIES	SITES	LATITUDE/LONGITUDE	PARAMETERS
HISTORICAL STUDIES (SELECTED)												
H37		Effects of County Land Use Policies and Management Practices on Anadromous Salmonids and Their Habitats	San Mateo County and FishNet 4C Program	Richard Harris and Susan Kocher	2001	FishNet 4C Program, UC Berkeley, San Mateo County, NMFS, State of California		Evaluation of county land management practices and written policies relative to protecting salmonid populations, and recommendations for improving those practices and policies.	San Francisquito Creek watershed	Not applicable	Not applicable	Policies including those re: planning review, wildlife habitat, riparian vegetation, floodplain management, channel modification and maintenance, streamflow quantity modification, sedimentation, water quality, and migration barriers; and practices including those re: stream crossing, emergency and routine culvert replacements, bridge construction, low water crossing, floodplain and riparian development, stream restoration, storm water management, site clearing and grading, spoils storage and disposal, streambank stabilization, landslide repair, channel and levee maintenance, road maintenance, subdivisions, wastewater treatment, and emergency flood control
H38		Annual Hydrologic Record and Preliminary Sediment Budget for Los Trancos Creek above Stanford's Felt Lake Diversion, Santa Clara and San Mateo Counties, California: Data Report for Water Year 2000	Stanford University	Balance Hydrologics	2000				Los Trancos Creek			
H39		High Resolution National Hydrography Dataset (NHD)	San Francisco Estuary Institute	USGS	2001	SCVWD		National Hydrography Dataset (NHD) in ArcInfo coverage of 1:24,000 USGS Digital Line Graphs (DLG).	San Francisquito Creek watershed (a subbasin of the Coyote Catalog Unit)	Not applicable	Not applicable	Stream name and reach code attributes. SFEI also has 1:24,000 DLGs, DEMs, and the tone balanced 1998 black and white aerial photo.

LEGEND

To facilitate identifying individual studies, the following alphanumeric nomenclature is used:

- C# = Current study (e.g., C29 – Long-term Water Quality Monitoring)
- H# = Historical study (e.g., H22 – Allardt and Grunsky's 1888 inspection)
- P# = Potential study (e.g., P15 – Long-term monitoring of upper watersheds)

To facilitate tracking studies when their status changes (e.g., from a current study to a historical study), present and past designations are shown:
H30 = C8 Adult Steelhead Passage in the Bear Creek Watershed

Appendix C. Guidelines on Basic Information Requested in Study Plans and Reports

For each project, the following types of information should be provided:

Sponsor

What organization is sponsoring or overseeing the study?

LTMAP Objective(s) Addressed

Which of the overall San Francisquito Creek long-term monitoring and assessment program objectives does this project address?

Brief Rationale for Monitoring/Assessment Project

What is the major issue motivating the project?

Overview of Monitoring or Assessment Project

A brief description of the planned monitoring or assessment activities; e.g., type of monitoring to be conducted, site(s), parameter(s), duration/frequency, etc.

Tributaries -

Sites -

Parameters -

Key Questions

What are the specific questions from which the project objectives and study plan were derived?

Project Objectives

What specific project objectives has the project been designed to address?

Quality Assurance / Quality Control

What are the basic attributes of the QA/QC program for the study?

Follow-up/Assessments

What assessments are planned for or could be applied to the monitoring data?

Options/Additional Work

What additional monitoring or assessments could be used to supplement or follow up on the planned project?

Sampling and Analysis Plan: San Francisquito Creek Watershed Surface Water Quality Monitoring

2001/02

Prepared for:
City of Palo Alto

Prepared by:
Larry Walker Associates

Sampling and Analysis Plan: San Francisquito Creek Watershed Surface Water Quality Monitoring

2001/02

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FIGURES AND TABLES

APPENDICES

Sampling and Analysis Plan: San Francisquito Creek Watershed Surface Water Quality Monitoring

2001/02

Introduction

This document provides detailed protocols for surface water quality monitoring within the San Francisquito Creek watershed. The surface water monitoring program addresses specific components of the Long-Term Monitoring and Assessment Plan (LTMAP) developed for the San Francisquito Creek watershed. The LTMAP was created by a subcommittee of the San Francisquito Creek Coordinated Resource Management and Planning (CRMP) Steering Committee to provide a comprehensive framework for organizing and coordinating monitoring and assessment activities within the watershed.

The surface water monitoring program is designed to address the "Chemical 1" objective (assess known, Clean Water Act Section 303(d) pollutants), and the "Chemical 2" objective (assess other potential pollutants), as described in the LTMAP, for San Francisquito Creek and its major tributaries.

Diazinon (a widely-used organophosphate pesticide) and sediment have been listed as causes of impairment to SF Creek quality in the most recent (1998) Clean Water Act (CWA) Section 303(d) list of impaired water bodies. These constituents are therefore considered to represent "known pollutants". Other, potential pollutants in SF Creek include heavy metals, nutrients, other pesticides, dioxins, and PCBs.

Purpose and Objectives

The overall purpose of this monitoring program is to characterize surface water quality at key locations within and tributary to San Francisquito Creek.

Questions identified within the LTMAP and prompting this monitoring program include:

- What are the in-stream levels of parameters listed as causes of impairment on the CWA Section 303(d) list for SF Creek (diazinon, sediment), and what are the sources of the observed in-stream levels?
- Are the 303(d)-listed pollutants or other pollutants present in the creek at levels that may be toxic to aquatic life or that exceed California Toxics Rule (CTR) standards?
- How does water quality vary spatially within the watershed; specifically, how does surface water quality change from upstream to downstream, especially as the Creek flows through the urbanized area (from below Searsville dam to SF bay)?
- How does in-stream water quality vary temporally (diurnally, within rainfall/runoff events, from one rainfall/runoff event to another, seasonally as the wet season progresses, and annually)?
- What are the annual loadings of key pollutants from SF Creek to SF Bay?

Specific surface water monitoring program objectives include:

1. Characterize the water quality of SF Creek and its tributaries at locations representative of the major lotic segments within the watershed, for known and suspected (potential) pollutants and related water quality parameters.
2. Monitor the water quality of SF Creek and its tributaries at sufficient frequency to characterize temporal (seasonal) variability in the concentrations of known and suspected (potential) pollutants and related water quality parameters.
3. Provide stream flow measurements at the representative monitoring locations to support loading calculations and other data analysis and interpretation efforts.
4. Communicate information (such as creek flow data) that can be used in other ongoing or planned studies within the watershed, and coordinate efforts with those studies to the extent practical.

Assessments of the monitoring data are planned to include:

- Comparisons of measured water quality to California Toxics Rule (CTR) standards for toxic pollutants,
- Analysis of spatial variation in surface water quality within the watershed, including comparisons of SF Creek water quality upstream and downstream of the urban area,
- Identification of sources of spatial changes in water quality (this will involve evaluation of data from this program and others, including monitoring conducted by the City of Palo Alto, Stanford Linear Accelerator Center, Stanford University, and others),
- Calculation of in-stream loadings from pollutant concentration and flow data, and
- Evaluations of temporal (seasonal) variability and long-term trends in in-stream water quality.

The monitoring activities described in this plan are designed to address these questions and objectives, and provide information necessary to conduct the assessments listed above. See the Data Quality Evaluation Plan for this project for Data Quality Objectives and procedures for data evaluation/review/validation/qualification.

Monitoring Overview

The surface water monitoring program involves both event-based creek sampling and analysis, and semi-continuous monitoring of field-measured water quality parameters.

The event-based monitoring includes periodic (ideally monthly) sample collection and analysis throughout the year (when flow is present), plus storm event-based monitoring during the wet season (October - May) for three storm events per year. Flow-proportional composite samples are collected using automated samplers and flow meters, supplemented by grab sampling for specific constituents where required by EPA protocols. Flow and composite sampling information is recorded automatically by on-site data recorders integral with the flow meters. All sample collection for toxic constituents is performed using “clean techniques”. Low-detection-level analytical methods are used for analysis of trace metals and organic compounds. A comprehensive QA/QC program is specified to cover both field and laboratory procedures.

The list of monitoring constituents covers the known and suspected potential pollutants identified within the LTMAP, plus related water quality parameters designed to assist in data interpretation and analysis (see list, Table 1).

The semi-continuous monitoring includes automated field measurement of pH, temperature, electrical conductivity, and dissolved oxygen at specified intervals. These parameters are measured through a set of probes installed at each monitoring station, which feed into electronic modules integrated into the flow meter data recorders. The on-site data recorders are remotely accessible via computer and modem.

Monitoring Site Locations

Long-term monitoring sites with fully-automated monitoring stations include:

1. SF Creek at the Newell Street bridge (downstream of most of the SF Creek watershed urban area)
2. SF Creek at Piers Lane, upstream of the confluence with Los Trancos Creek (upstream of most of the urban area)
3. Los Trancos Creek at Piers Lane, upstream of its confluence with SF Creek (the major tributary input to SF Creek within the urbanized reach)

Other monitoring sites are planned for future equipment installation. See site location map, Figure 1. As-built drawings of the monitoring installations at sites 1-3 are included in Appendix A.

Table 1. Surface Water Monitoring Constituents – LTMAP Stations

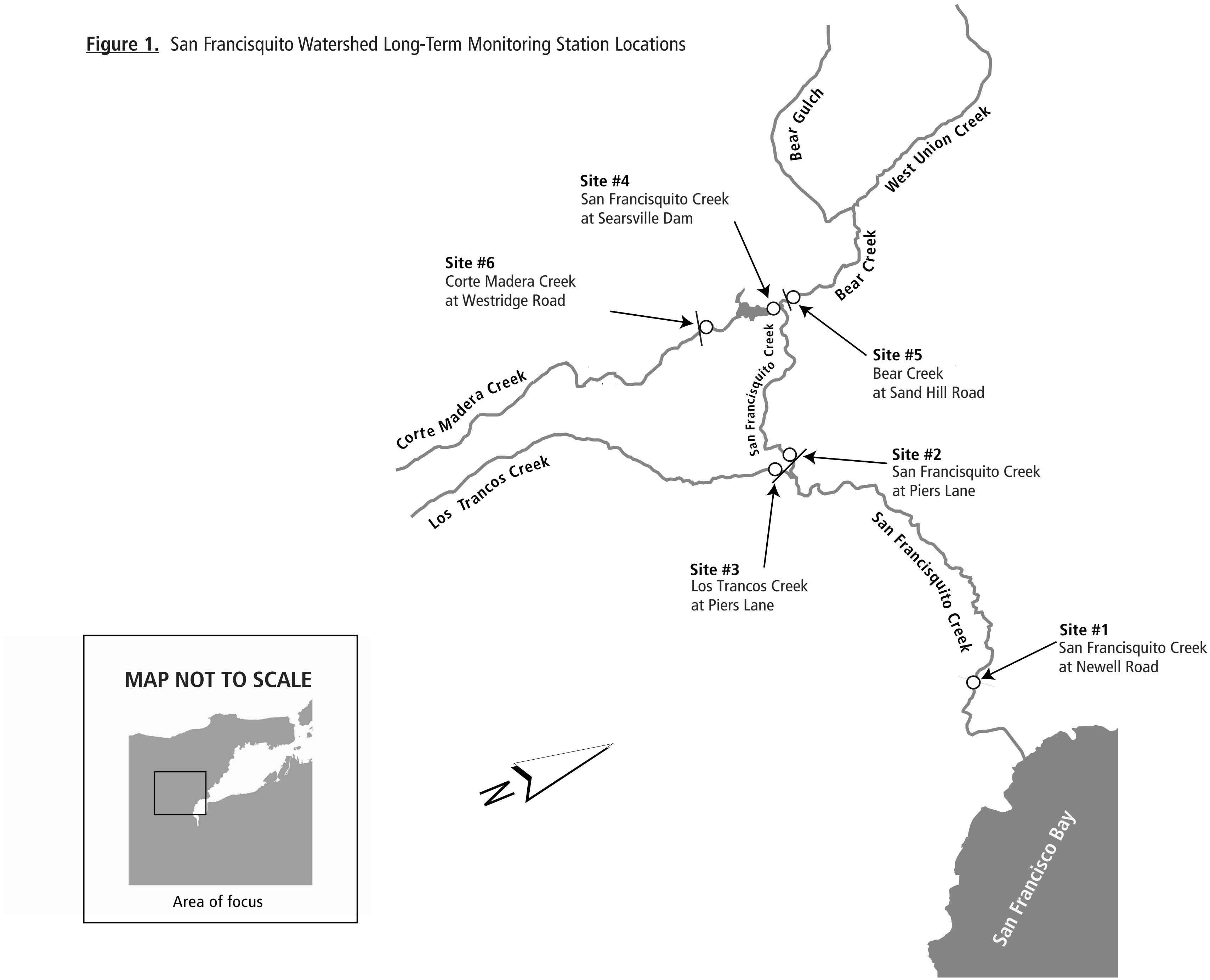
For all sites:

- Metals (total* and dissolved):
  - Aluminum
  - Copper
  - Lead
  - Mercury
  - Nickel
  - Selenium
  - Silver
  - Zinc
  - (add methyl-mercury if monitoring shows elevated mercury above CTR level)
  - * analytically, referred to as "total recoverable"
- Organophosphate pesticides:
  - Diazinon
  - Chlorpyrifos
- Conventionals:
  - Hardness
  - TSS
- Nutrients:
  - Ammonia
  - Nitrate
  - Phosphorous (total)
- Field Measurements:
  - pH
  - Dissolved Oxygen
  - Temperature
  - Conductivity
  - Stream Flow
  - Other Observations

For discharge to Bay (Newell Rd. station), add:

- Arsenic (total and dissolved)
- Organochlorine Pesticides:
  - Chlordane
  - Dieldrin
  - DDT
  - PCBs
- Dioxins and Furans

Figure 1. San Francisquito Watershed Long-Term Monitoring Station Locations



Automated Monitoring Equipment

Each site is equipped with an automated sample collection system configured to collect flow-proportioned (flow-weighted) composite samples, which provide the most accurate means for estimating EMCs[1] and pollutant loads. The monitoring equipment is protected in a locking, heavy-gauge, steel enclosure at each site. The key components of the automated monitoring systems are:

Sample Collection:
- American Sigma 900 automatic sampler,
- Flexible pump tubing,
- Teflon sample intake tubing and Teflon-coated strainer, and
- Borosilicate glass composite sample bottle.

Flow/Rainfall Measurement:
- American Sigma 950 flow meter,
- Ultrasonic flow sensor and cable, and
- Rain gauge (SF Creek at Piers Lane only).

Water Quality Parameter Measurement:
- Dissolved oxygen/temperature probe and cable,
- Electrical conductivity probe and cable,
- pH/temperature probe and cable.

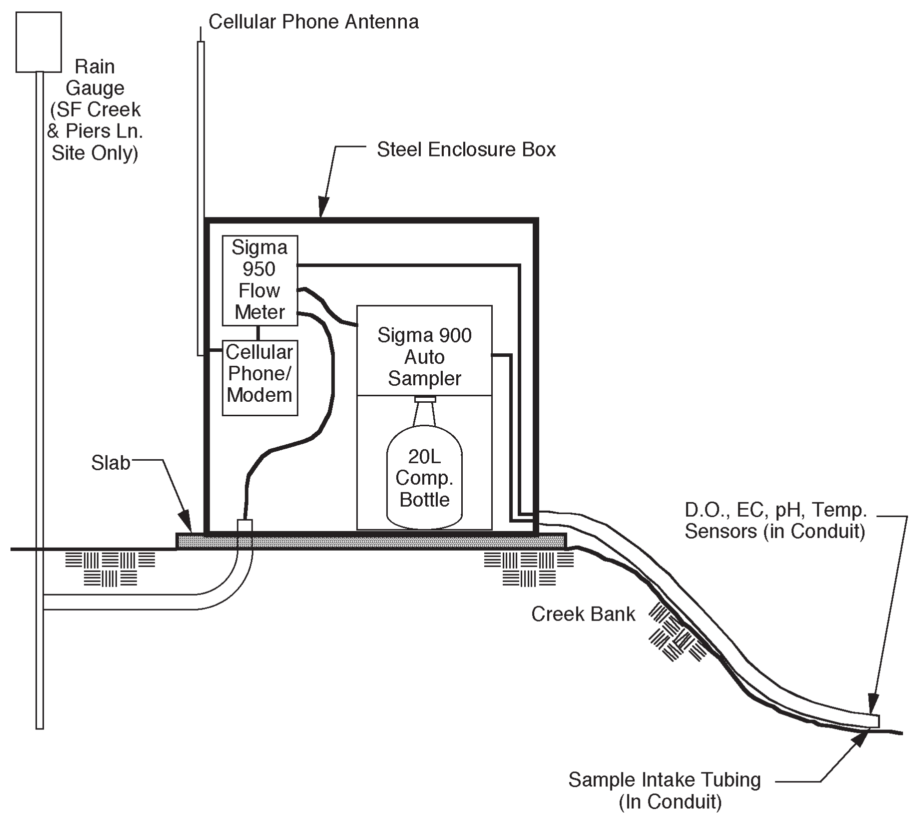
Data Recording/Retrieval:
- American Sigma 950 flow meter (datalogger),
- Insight system software,
- Cellular telephone/modem for remote communications, and
- Optional secondary/back-up power source.

[1] The event mean concentration (EMC) is a statistical parameter that describes the average concentration of a given constituent at a specific location during a monitoring event.

The configuration of these components is illustrated schematically in Figure 2. All cables and tubing leading out of the equipment enclosure are enclosed in metal conduit.

At site 1 AC the equipment runs on AC power provided from the City electrical utility. At sites 2 and 3 power is provided by three 12-volt deep-cycle marine batteries, one each for the 950 flow meter, 900 autosampler, and cell phone/modem.

Figure 2. Automated Monitoring Equipment Schematic



Communications/Project Organization

The project participants, organization of responsibilities, and lines of communication are shown in the telephone tree, Figure 3.

Figure 3. Telephone Tree (intentionally not included)

Update annually with complete list of contacts:

project managers,
field personnel,
weather forecasters,
courier services,
lab personnel, and
emergency services.

Show all applicable phone numbers:

office, home, cellular, pager.

Equipment Maintenance and Preparation

Monitoring station maintenance and preparation must be performed regularly to maintain the automated equipment in proper working order. The comprehensive maintenance described in this section is typically done annually, before the beginning of the wet season.

However, the equipment and sites also should be inspected on a routine basis, particularly prior to each monitoring event, and additional maintenance should be performed as needed. *In particular, the 12 volt batteries must be replaced and recharged at sites 2 and 3 on a regular basis (likely twice monthly). The water quality probes also must be cleaned and calibrated regularly (at least monthly).*

The key components of the annual maintenance and preparation activities are:

- Inspect and prepare the area of the site to assure safe access,
- Install clean sampler tubing and strainers,
- Check the functions and performance of the automated equipment, including calibration and testing,
- Check and replace field crew equipment as needed,
- Update the telephone tree, and
- Conduct refresher training.

These items are discussed on the following page.

Site Assessment

Each monitoring site should be inspected for damage, and site access should be cleared by cutting back or removing weed growth as needed. Safety and security should be generally assessed by checking sites for damage to equipment or nearby structures, and for the presence of discarded items, fallen tree limbs, etc. Any impediments to safe access should be noted and cleared, making use of appropriate equipment or personnel as needed. Field crews should not attempt to clear items that can not be moved safely and easily. Locks should be checked for proper function. Any safety or security concerns should be promptly corrected or relayed to the appropriate local maintenance department or law enforcement agency.

Tubing/Strainer Replacement

At least annually (typically prior to the beginning of the wet season), the Teflon suction tubing, flexible pump tubing, and Teflon-coated strainer will be removed from the automated installations, inspected for damage, and cleaned as specified in Appendix B. The tubing and strainer are then reinstalled, on a second site visit, using clean techniques. Tubing also should be inspected prior to each monitoring event and changed as needed throughout the year.

Equipment Function and Calibration

Annually, typically in conjunction with the tubing and strainer replacement, additional maintenance will be performed at each of the automated sampling installations. In addition to site access inspections and tubing replacement, these activities normally include:

- inspection of all conduit and electrical connections;
- collection of equipment blank samples (see discussion in QA/QC section);
- replacement of internal memory batteries in all components;
- installation of new desiccant packs in sampler and flow meter;
- updating of flow volume per aliquot formula for each site as appropriate based on available rainfall/runoff information, and
- calibration and testing of the sampler, flow meter, rain gauge, and field-measurement probes (per directions contained in manufacturers' manuals).

The specific sequence of related annual maintenance and preparation items is specified in the Pre-Season Maintenance Checklist (Figure 4). See Appendix C for specific steps related to maintenance and calibration of the American Sigma equipment.

Bottle and Tubing Cleaning

Composite sample bottles, automated sampler tubing, and intake strainers must be pre-cleaned so as to minimize potential contamination by trace metals and organic compounds, according to the protocols described in Appendix B.

Field Equipment Preparation

The field crew should maintain a field kit containing an assortment of tools and supplies commonly needed during maintenance and monitoring event site visits (see Figure 5). The field kit is commonly assembled in a sturdy tool box with a handy carrying handle. The field kit then becomes one item in the list of equipment needed for monitoring events (see Figure 6). Annually, the field crew should inventory field equipment against the checklists (Figures 5 and 6) and replace items as necessary.

Update Telephone Tree

The telephone tree (Figure 3) should be reviewed and updated as necessary.

Refresher Training

Training should be scheduled annually to provide a refresher/update for experienced field personnel and provide complete information for new program personnel.

Figure 4. Pre-Season Maintenance Checklist

On the first pre-season site visit:

- ❑ Inspect area and equipment for damage
- ❑ Clear site access; perform weed control as needed
- ❑ Check electrical connections
- ❑ Replace internal (memory) batteries
- ❑ Replace sampler and flow meter desiccant packs
- ❑ Inspect conduit
- ❑ Inspect sample intake area
- ❑ Inspect field probes
- ❑ Check rain gauge (if present)
- ❑ Remove tubing and strainers
- ❑ Remove and recharge external (12 volt) batteries (if present)

On the second pre-season site visit:

- ❑ Collect equipment blank samples at specified site(s) (see QA/QC section)
- ❑ Install cleaned tubing and strainers using clean techniques
- ❑ Check sample intake and pump tubing and tubing connections
- ❑ Check moisture indicators in sampler and flow meter
- ❑ Calibrate and program sampler and flow meter
- ❑ Install clean composite bottle
- ❑ Calibrate rain gauge (if present)
- ❑ Calibrate field measurement probes
- ❑ Fill out log sheet

Figure 5. Field Kit Checklist

- ❑ Keys (to gates and to sampler enclosures)
- ❑ Flashlights (2)
- ❑ Large flat screwdriver
- ❑ Small flat screwdriver
- ❑ Umbrella
- ❑ Spare sample labels
- ❑ Pencils (2) and waterproof markers (2)
- ❑ Desiccant (for Sigma samplers and flow meters)
- ❑ Diagonal clippers
- ❑ Electrical tape
- ❑ Cable ties (assorted sizes)
- ❑ Utility knife
- ❑ Zip lock baggies (assorted sizes)
- ❑ Powder-free nitrile gloves
- ❑ Rubber bands
- ❑ Camera
- ❑ Duct tape

Figure 6. Field Crew Equipment Checklist

- ❑ Field Kit
- ❑ Sampling Plan
- ❑ Log books
- ❑ Pre-printed bottle labels
- ❑ Chain-of-custody forms
- ❑ Paper towels
- ❑ D.I. water squirt bottles
- ❑ Replacement composite bottles
- ❑ Coolers and ice
- ❑ Lab-provided blank water for field blanks
- ❑ Cellular phone with extra battery
- ❑ Personal rain gear
- ❑ Any necessary safety gear
- ❑ Grab sample bottles
- ❑ QA/QC sample bottles
- ❑ Grab pole, Teflon bailer(s), and string (if necessary)

Monitoring Event Preparation

Pre-event activities include placing a bottle order, preparing bottle labels, checking field kit and field equipment lists, purchasing ice, programming the automated equipment, and performing on-site monitoring station preparation.

Event-Specific Sample Schedule

A one-page, event-specific list of samples to be collected at each site should be prepared prior to each monitoring event. The list should cover all composite and grab samples, and include the QA/QC samples planned for each site, per the QA/QC sample schedule (see QA/QC section). This list can then be used to prepare the bottle order, prepare all necessary bottle labels, guide monitoring personnel in automated sampler programming, assist the field crews in scheduling grab sample collection, and guide monitoring personnel in post-event composite sample breakdown and sample distribution.

Bottle Order

Before each monitoring event, sample bottle orders are placed with the analytical laboratories. Bottles are ordered for all planned samples, including composite carboys, composite sample breakdown bottles, grab sample bottles, and additional bottles needed for quality control samples (see QA/QC section). The bottle order should also include blank water for the collection of required field blank samples (see QA/QC section). The bottles must be the proper size and material, and contain preservatives as appropriate for the specified laboratory analytical methods (see Table 2). Composite bottles must be pre-cleaned according to the procedures specified in Appendix B.

Extra bottles should be ordered in case of accidental breakage, contamination, or loss. Field crews must inventory sample bottles upon receipt from the laboratory to ensure that adequate bottles have been provided to account for the analytical requirements of all composite and grab samples.

Bottle Labels

All sample bottles should be pre-labeled to the extent possible before each stormwater monitoring event. Pre-labeling sample bottles simplifies field activities, leaving only date, time, sample number, and sampling personnel names to be filled out in the field. Each bottle label should include the following information:

- Project Name
- Site ID #, Site Name
- Date and Time
- Sample Type (grab or composite)
- Bottle __ of __ (for multi-bottle samples)
- Sample Collected by
- Preservative (if any)
- Analysis

Because field blank and field duplicate samples are typically sent to the analytical laboratory “blind”, bottle labels for these QA/QC samples should be completed with pseudonym site names (see below). Actual QA/QC sample collection site information must be carefully noted in the field log.

Station Numbers and Names

Surface water quality sites monitored during 2001-02 shall be designated by the site numbers and names listed below.

SITE #	SITE NAME
1	SF Creek at Newell St.
2	SF Creek at Piers La.
3	Los Trancos Creek at Piers La.

In addition, quality control samples submitted "blind" to the laboratory should be designated by the pseudonyms and site numbers listed below.

SITE #	SITE NAME	QC SAMPLE
101	Clear Creek at Upland Ct	(field blank)
102	Sandy Creek at Second St.	(field duplicate)

Bottles should be labeled in a dry environment prior to field crew mobilization. Attempting to apply labels to sample bottles after filling can cause problems, as labels usually do not adhere to wet bottles. The labels should be applied to the bottles rather than to the caps.

Water-proof bottle labels are available pre-printed with space to pre-label by hand writing or typing. Custom bottle labels may be produced using blank water-proof labels and labeling software. Computer labeling programs can save a great deal of time in generating bottle labels. The sites and analytical constituent information can be entered in the computer program for each monitoring program in advance, and printed as needed prior to each monitoring event.

Field Equipment Inventory

The field crew will inventory field equipment (see Figures 5 and 6 for storm kit and field equipment checklists) and replace items as necessary. The field crew should specifically verify that grab sample bottles, bottle labels, and adequate bottles for the planned QA/QC samples are on hand. The field crew also should verify that an appropriate vehicle is available for use prior to monitoring events.

Ice

If sample collection is conducted at a station without a refrigerated sampler, or if grab samples are required, the field crew will need to obtain ice (for sample preservation) on the way to the sampling station. Composite sample bottles are required to be kept in a refrigerated sampler, or surrounded with ice during sample collection. Ice for grab samples should be kept in ice chests where full grab sample bottles will be placed. Keeping ice in double zip-lock bags facilitates clean and easy ice handling.

Refreezable ice packets are not recommended because they are susceptible to leakage.

Automated System Programming

The automated sampler/flow meter system must be programmed before each monitoring event to ensure that sufficient composite sample volume will be collected to perform all of the desired analyses for each site, including QA/QC analysis. This involves the following basic steps:

- Thresholds are set for all sampling locations to allow stations to enter sample collection mode. Thresholds can include the minimum precipitation amount, flow depth, or flow volume required to initiate the sample collection routine. See the Sigma 950 flow meter manual, Chapter 3, for options for “Sampling Triggers” and “Setpoint Sampling” programming instructions.
- The sampler is switched from non-monitoring mode (“Program Halted”) to monitoring mode (“Program Running”).
- For flow-paced composite sampling, the flow volume per sample (i.e., the creek flow volume that passes between each composite aliquot collected) is set based on the expected creek flow volume during the event (based on rainfall/runoff calculations for storm-based events). See additional information below.

Flow-Pacing

The final composite sample volume is a function of the sample aliquot size and the number of aliquots collected during the monitoring event. The number of aliquots collected is determined by the sampling (flow-pacing) rate and the actual creek flow during the monitoring event. To obtain the desired composite sample volume, each automatic sampler will be programmed with a specific sample aliquot size (typically 500 ml.), and the flow-pacing will be set to collect the appropriate number of samples, based on the projected rainfall amount and resulting creek flow volume.

To collect flow-proportioned composite samples, the Sigma 950 flow meter is programmed to send a pulse to the Sigma 900 sampler each time a specified creek flow volume has passed the flow sensor. The sampler, in turn, is programmed to collect a sample each time it receives a pulse from the flow meter. Therefore, each time the programmed flow volume per sample has passed the sampling location, a composite sample aliquot is collected.

For wet weather events, the flow volume per sample (the amount of flow that passes the sampling point between each aliquot collected) must be programmed into the flow meter in proportion to the predicted rainfall amount for each storm event, to set the sample pacing so as to fill the composite bottle(s) at an appropriate rate.

The borosilicate composite bottles have a capacity of 20 liters. The automatic sampler is programmed to collect a specific number of composite sample aliquots of specific volume before halting the sampling program, so as to fill the composite bottle(s) to the desired level, without overfilling. At a nominal sample aliquot size of 500 mL, the sampler can collect 40 aliquots before over-filling.

To calculate creek flow volume per sample aliquot:

Use the following formulas for each site to calculate the creek flow volume (in cubic feet) per composite sample aliquot:

Site #1, SF Creek at Newell: Pacing volume = QPF * 1,655,000

Site #2, SF Creek at Piers: Pacing volume = QPF * 1,037,000

Site #3, Los Trancos Creek at Piers: Pacing volume = QPF * 273,000

Where: QPF = the quantity of precipitation forecast, in inches

The calculation is based on the general formulation:
flow volume/aliquot (c.f.) = QPF (in.) x watershed area (acres) x runoff coefficient x conversion factor/desired # aliquots

Program the resulting flow volume (in cubic feet) into the Sigma 950 Sampler Pacing screen as described below. Note that these formulas are rough, simple initial estimates that should be refined based on empirical rainfall/runoff data when available.

To set flow-pacing prior to a monitoring event:

From the Main Menu on the Sigma 950 flow meter, select:

SETUP/MODIFY SELECTED ITEMS/SAMPLER PACING

Then enter the flow interval between pulses (see how to calculate, above), and the unit of measure (generally use cubic feet).

The Sampler Pacing also may be reset remotely using the Insight software.
Once connected to the Sigma 950 flow meter:

- ❑ Select: Remote Programming
- ❑ Double-click on Sampler Pacing
- ❑ Select “Sampler Pacing: Enabled”
- ❑ Change “Trigger sampler every” volume as per the flow volume per aliquot calculation, above

For wet weather events, the flow-pacing sometimes ends up being too fast (when rainfall or runoff are greater than expected), and composite carboys may fill prior to the end of the event; in such cases also will a composite bottle change be needed.

The automatic sampler programming will be reset by monitoring personnel prior to each monitoring event. The timing of sampler reset will depend on predicted and observed rainfall.

Automatic sampling at each of the sites will begin after clean composite bottles are installed by field crews, the sampler has been set to “Program Running”, and pre-specified event criteria (Sampling Triggers) have been met.

Remote Communications

The automated monitoring equipment has been set up for remote communications via cell phone modem and personal computer running the Insight software by American Sigma.

The remote modem must be programmed through the Insight software to communicate at 1200 baud.

Pre-Monitoring Event Station Preparation

When a monitoring event is imminent (usually within 24 hours) the following activities will be performed by the field crew at each of the monitoring stations:

- ❑ Check electrical and sample tubing connections.
- ❑ Check pump tubing for wear. Replace if necessary.
- ❑ Check moisture indicators in sampler and flow meter.
- ❑ Verify that station variables have been correctly set.
- ❑ Set sample pacing based on storm QPF.
- ❑ Verify that clean composite bottle is installed, with tubing in place.
- ❑ Add ice to non-refrigerated composite samplers.
- ❑ Visually inspect intake. Clear debris if necessary.
- ❑ Fill out log sheet.
- ❑ Verify that the Sigma sampler display reads "Program Running".

See Appendix C for additional details on programming and calibration of the American Sigma 950 flow meter and 900 automatic sampler.

Sample Collection

When possible, samples will be collected as flow-proportioned composite samples, to better represent creek water quality during a specified monitoring period. For certain constituents, EPA protocols specify that samples may not be collected as composites, and must be collected as "grabs". See detailed composite and grab sampling methods following.

Constituents for which samples will be collected, the sample volumes required, sample types, sampling containers and preservatives used are listed in Table 2.

Table 2. Sample Bottles, Analyses, Volumes, Type, and Preservation

BOTTLE	ANALYSIS	OPTIMUM VOLUME	SAMPLE TYPE	PRESERVATION
FOR ALL SITES				
500 mL	PE Low Level Metals, dissolved & total recoverable (Al, Cu, Pb, Ni, Se, Ag, & Zn)	0.50 L	Composite	4˚C; filter for dissolved ASAP; then preserve ASAP
250 mL Teflon or glass	Mercury, dissolved & total	0.25 L	Grab	4˚C
2 X 1.0 L Amber Glass	OP-Pesticides (EPA Method 8141)	2.00 L	Composite	4˚C
250 mL PE	Total Hardness	0.10 L	Composite	4˚C, HNO3
1.0 L	PE Phosphorus, total	0.10 L	Composite	4˚C, H2SO4 to pH <2
	Nitrate	0.25 L	Composite	4˚C
	TSS	0.25 L	Composite	4˚C
500 mL PE	Ammonia	0.50 L	Grab	4˚C, H2SO4 to pH <2
FOR NEWELL STREET SITE ONLY				
500 mL PE	dissolved & total As	0.50 L	Composite	4˚C; filter for dissolved ASAP; preserve ASAP
2 X 1.0 L Amber Glass	OC-Pesticides/PCBs (EPA Method 8081)	2.00 L	Composite	4˚C
2 X 1.0 L Amber Glass	Dioxins and Furans (EPA Method 8290)	2.00 L	Composite	4˚C

Clean Sample Handling

"Clean sampling" techniques are required to collect and handle water samples in a way that results in neither contamination, loss, or change in the chemical form of the analytes of interest. Clean techniques are required for handling all sample bottles and equipment used to collect samples for low-level metals analysis. Samples are collected using rigorous protocols, based on EPA Method 1669, as summarized below:

- Samples are collected only into rigorously pre-cleaned sample bottles.
- At least two persons, wearing clean, powder-free nitrile gloves at all times, are required on a sampling crew.
- One person ("dirty hands") touches and opens only the outer bag of all double bagged items (such as sample bottles, tubing, strainers and lids), avoiding touching the inside of the bag.
- The other person ("clean hands") reaches into the outer bag, opens the inner bag, and removes the clean item (sample bottle, tubing, lid, strainer, etc.).
- After a grab sample is collected, or when a clean item must be re-bagged, it is done in the opposite order from which it was removed.
- Clean, powder-free nitrile gloves are changed whenever something not known to be clean has been touched.
- For this program, clean techniques must be employed whenever handling the composite bottles, Teflon lids, suction tubing, strainers, or mercury grab sample bottles. During composite sample splitting, the metals bottles are also handled using clean techniques.
- To reduce potential contamination, sample collection personnel will adhere to the following rules at all times while collecting or handling samples:
  - No smoking!
  - Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles).
  - Minimize the amount of time any sample container is left open.
  - Do not place lids down where they may accumulate contaminants.
  - Prevent foreign material (blowing dust, leaves, etc.) from entering an open sample bottle.
  - Never touch the inside surfaces of sample bottles, lids, or composite carboys, even with gloved hands.
  - Never touch the exposed end of a sampling tube.
  - Avoid allowing rainwater to drip from rain gear into sample bottles.
  - Do not eat or drink during sample collection.
  - Do not breathe, sneeze or cough in the direction of an open sample bottle.

Composite Sample Collection

Composite sample collection will commence automatically when the flow meter sampling triggers have been met, and will continue until the composite bottle is full or sampling is manually discontinued. Composite samples are collected into specially-cleaned 20 liter borosilicate glass composite bottles (carboys), using the Sigma automated sampler and flow meter to provide flow-proportioned composites. At the end of the compositing period, the composite samples are split into appropriate bottles for delivery to the analytical laboratories.

For dry weather events, the nominal compositing period will be 24 hours, to capture diurnal variability in creek quality. For wet weather events, the compositing period ideally will cover the storm hydrograph, terminating when creek level returns to within about one foot (or less) of pre-storm levels (to be adjusted as necessary based on field experience at each site). A 24 hour limit may be applied to storm-based composite sampling as well, for practical, logistical reasons.

To ensure the collection of representative samples, automatic samplers are programmed to perform a full back purge cycle between each sample aliquot collected. When multiple sample containers are used, samplers should be programmed to perform a full back purge cycle prior to the filling of each individual container. Purging the sample intake tube prior to the collection of each aliquot or individual container sample helps to keep the sample intake line clear. Debris which collects at the sample tubing intake may cause flow restriction, which reduces velocities within the intake tube. When intake tube velocities are reduced heavier particulates may not be adequately represented in the sample aliquots. Additionally, reduced velocities may result in sampler aliquot volume calibration problems, or increased pump tubing wear. Automatic samplers may also be programmed to perform rinse cycles after the back purge cycle and prior to the collection of sample aliquots. However, for stations that have a high sampling head height or a long intake tubing length, rinse cycles are not advised because of additional wear on the pump tubing. Worn or split pump tubing will result in missed sample aliquots.

When QA/QC sample volumes or special project requirements indicate composite volumes in excess of 20 liters, two composite carboys can be used sequentially. In such cases the field crews will need to plan to change the composite bottle at mid-event.

Data are downloaded from the Sigma 950 flow meter/data logger to a personal computer (PC) immediately following the storm event.

Grab Sample Collection

One set of grab samples will be taken at each site during each event. It is generally preferred that the grab samples be collected near the middle of the monitoring event for dry weather events, and near peak flow for wet weather events. However, due to the difficulty in predicting the time of peak flow during storms, timing grab sampling to match peak flow may be problematic. Therefore, to the extent possible, wet weather grab samples will be collected during the rising limb of the storm hydrograph, at a time when flow rates are increasing and precipitation rates are decreasing.

- ❑ Pre-label sample containers (site code, location, date, time, analysis).
- ❑ Collect Field Blanks for grab samples, if needed, (mercury only).
- ❑ Collect Grab Samples using clean techniques; wear clean gloves when handling bailer, bottles, and caps.
- ❑ Record mercury bottle number and collection information in field notes and on chain-of-custody.

For ammonia samples:

- ❑ Attach clean Teflon bailer to grab pole/line;
- ❑ Fill bailer with sample (sample bottles with preservative should not be filled past the top of the sample bottle or in any other manner that would result in the loss of the preservation chemicals).
- ❑ Pour sample water from bailer into ammonia bottles.

For mercury sample:

Collect mercury sample using Sigma pump. Redirect the pump tubing end that hangs into the composite bottle towards the Teflon mercury sample bottles, using clean techniques. Pump sufficient sample through the Sigma sampler to fill the 250 ml Teflon bottles for total and dissolved mercury. This is done by pressing "CHANGE/HALT" on the Sigma sampler, pressing and holding "PUMP" to fill the container, and pressing "RESUME PROGRAM" to return to automated compositing. Clean handling techniques must be used when handling the pump tubing and sample bottle lids.

Collect Duplicate Samples if needed using the same protocols described above.

Changing a Composite Sample Bottle

If the one 20-liter composite bottle setup is used, it may be necessary to change a composite bottle. This is done by pressing "CHANGE/HALT" on the Sigma sampler, removing and replacing the composite bottle, and pressing "RESUME PROGRAM" to return to automated compositing. Clean techniques must be used when handing the composite bottles, lids, and sampler tubing during any composite bottle change.

Prior to Leaving the Site

- ❑ Add ice to all collected sample coolers/carrying buckets
- ❑ Inspect monitoring equipment (tubing, composite bottle positioning, etc.)
- ❑ Fill out field log sheet
- ❑ Double-check that Sigma sampler display reads "Program Running"
- ❑ Secure the site; close and lock equipment enclosure

Note that it is very important to completely fill out a log field sheet during every site visit.

Termination of Sampling

Sampling normally can be terminated when either (1) 24 hours have passed, or (2) it is determined that the storm event is finished. Sampling stations will be visited at the end of each sampled storm to replace the composite bottle. Activities to perform during a station shut-down visit are listed below.

- ❑ Press "Change/Halt" on the Sigma sampler to terminate the sampling program
- ❑ Download the data from the Sigma 950 flow meter/data logger
- ❑ Remove full composite sample bottles and ice down
- ❑ Collect composite field blanks at site(s) as required by QA/QC schedule
- ❑ Fill out log sheet
- ❑ Deliver full composite bottles to staging area or laboratory for sample splitting and shipment

A field log sheet should be filled during each site visit, PRIOR TO LEAVING THE SITE. An example filed log form is provided as Figure 7.

Quality Control Samples

Quality control samples will be collected prior to the first monitoring event of the season and during each subsequent monitoring event according to the schedule presented in Table 3. Note that the three wet weather monitoring events and three dry weather events are combined in Table 3, covering the approximately six month wet season. Quality control sample results will be used for data evaluation and interpretation.

Pre-Storm Bottle and Equipment Blanks

All bottles, lids, strainers, and tubing will be cleaned according to specified procedures, and blanks will be evaluated for the presence of contamination as follows.

Equipment Blanks
Prior to the wet season, an equipment blank (blank water run through the cleaned tubing installed in the auto sampler) will be collected according to the QA/QC schedule in Table 3 and will be analyzed for total recoverable metals and Semi- and Non-Volatile Organics (EPA 625).

Bottle Rinsate Blanks
Prior to the first monitoring event the laboratories should collect a composite bottle rinsate blank and analyze the rinsate for Semi- and Non-Volatile Organics (EPA 625) and total recoverable metals.

Monitoring Event Quality Control Samples

The following quality control samples will be analyzed at least once at each site during each monitoring season (see Table 3 for example QA/QC sample collection schedule):

- Composite Field Blank (total recoverable metals and trace organics).
- Grab Field Blank (mercury analysis).
- Matrix Spike/Matrix Spike Duplicate (total recoverable metals and trace organics)
- Either a field duplicate or lab duplicate (all analyses)

Table 3. Wet Season QA/QC Schedule

LOCATION	PRE-SEASON	EVENT #1	EVENT #2	EVENT #3	EVENT #4	EVENT #5	EVENT #6
Labs	Carboy rinsate blank and metals sample bottle blank						
SF Creek at Newell	Equipment/Tubing Blank	Lab Dup	Field Blank	MS/MSD	Field Dup	Field Blank	MS/MSD
SF Creek at Piers		MS/MSD	Field Dup	Field Blank	MS/MSD	Lab Dup	Field Blank
Los Trancos Creek at Piers		Field Blank	MS/MSD	Lab Dup	Field Blank	MS/MSD	Field Dup

Note: Schedule applies to one half year (wet season), and assumes three wet weather and three dry weather events.

QA/QC Sample Collection Methods

Specific collection methods for each quality control sample type are described below.

Field Blank

Grab sample field blanks will be collected immediately prior to the collection of normal grab samples. The field crew will use the blank water provided (and Teflon bailer, if needed) and will fill each grab sample container according to standard procedures.

Composite sample field blanks will be collected at the time that the final composite bottle is removed from the sampler. Blank water will be poured directly into the composite container.

Field blanks will be submitted “blind” to the laboratory using the “Clear Creek” site name pseudonym. The date and time of sampling should be noted on the log sheet.

Field Duplicate

Field duplicates will be collected for the sites and monitoring events specified in Table 3.
Grab sample field duplicates will be collected immediately following and in the same manner as the environmental grab samples.

Composite sample field splits will be produced during the compositing process. Double the normal composite sample volume (2 X 8.5 liters = 17 L for the Newell Site; 2 X 4 liters = 8 L for the upstream sites) is required for these samples. Field duplicates and environmental sample containers will be filled in random order.

Field duplicates will be submitted “blind” to the laboratory using the “Sandy Creek” site name pseudonym. The date and time of sampling should be noted on the log sheet.

Laboratory Duplicate

Lab duplicate analyses will be requested on the specified samples following the schedule in Table 3. No special sampling considerations are required, besides the collection of double the normal composite sample volume and field-collected grab samples.

Matrix Spike/Duplicate

Matrix spike and matrix spike duplicate (MS/MSD) analyses will be requested on the specified sample for each storm. No special sampling considerations are required. However, additional sample volume must be collected for each analysis. An optimal additional composite volume of approximately 14 liters is required for the Newell site, and approximately 5 liters is required for the upstream sites. No grab samples require MS/MSD, except total recoverable mercury grabs, which do not require additional MS/MSD volume.

Sample Splitting, Shipment, and Analysis

Following collection of each sample, the sample container must be labeled, the chain-of-custody form must be filled out, and the sample must be shipped to the appropriate laboratory. These actions are described below.

Chain-of-Custody Forms

Chain-of-custody (COC) forms must be filled out for all samples submitted to each laboratory. Site #, site name, sample date, and analysis requested shall be noted on each COC. Special QA/Qc requirements, such as laboratory duplicate or MS/MSD, must be specified on the COC forms for the relevant samples and analyses.

If samples are not filtered for dissolved metals analysis in the field, the chain of custody form should state, "Filter for dissolved metals upon receipt." This prompt filtration service should be pre-arranged with the lab, so that they will plan to have someone on hand to perform the filtration upon receipt of the samples by the lab.

Transport to Lab

Samples will be hand delivered or sent via courier service to the appropriate laboratory for analysis. Samples must be kept on ice throughout the sample delivery process.

[Provide specific directions to lab(s), delivery/after hours drop off instructions, etc.]

Laboratory Analytical Methods

Samples will be analyzed by the analytical laboratories according to the methods specified in Table 4. Note that all analyses must be commenced within the maximum allowable holding times specified in Table 4.

QA/QC Data Evaluation

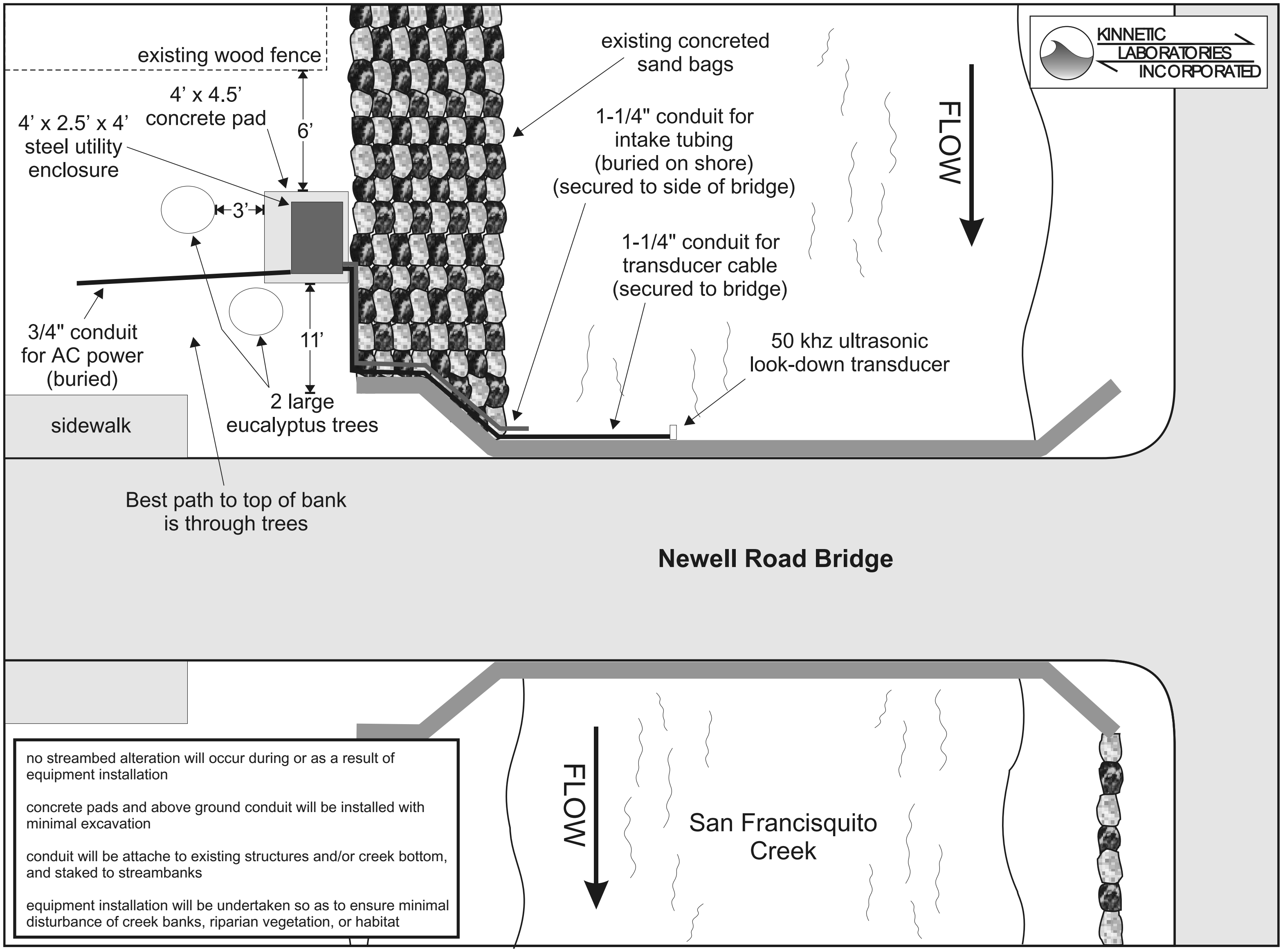
All lab data reports produced by the creek monitoring program must be checked to verify that all requested analyses were completed, that all requested results were reported (including laboratory internal QA/QC results), and that specifications for holding times, analytical methods, and detection limits were met by the laboratories. The data reviewer must promptly address any identified problems, and contact responsible laboratory personnel to request that the laboratories correct errors, provide missing information, or rerun sample analyses as needed.

A comprehensive evaluation must be performed of all QA/QC data produced by the analytical laboratories, the QA/QC results must be applied to the environmental sample data, and any data which do not meet data quality objectives must be qualified. Data quality objectives and data qualification procedures and qualifier codes are specified in the project Data Quality Evaluation Plan.

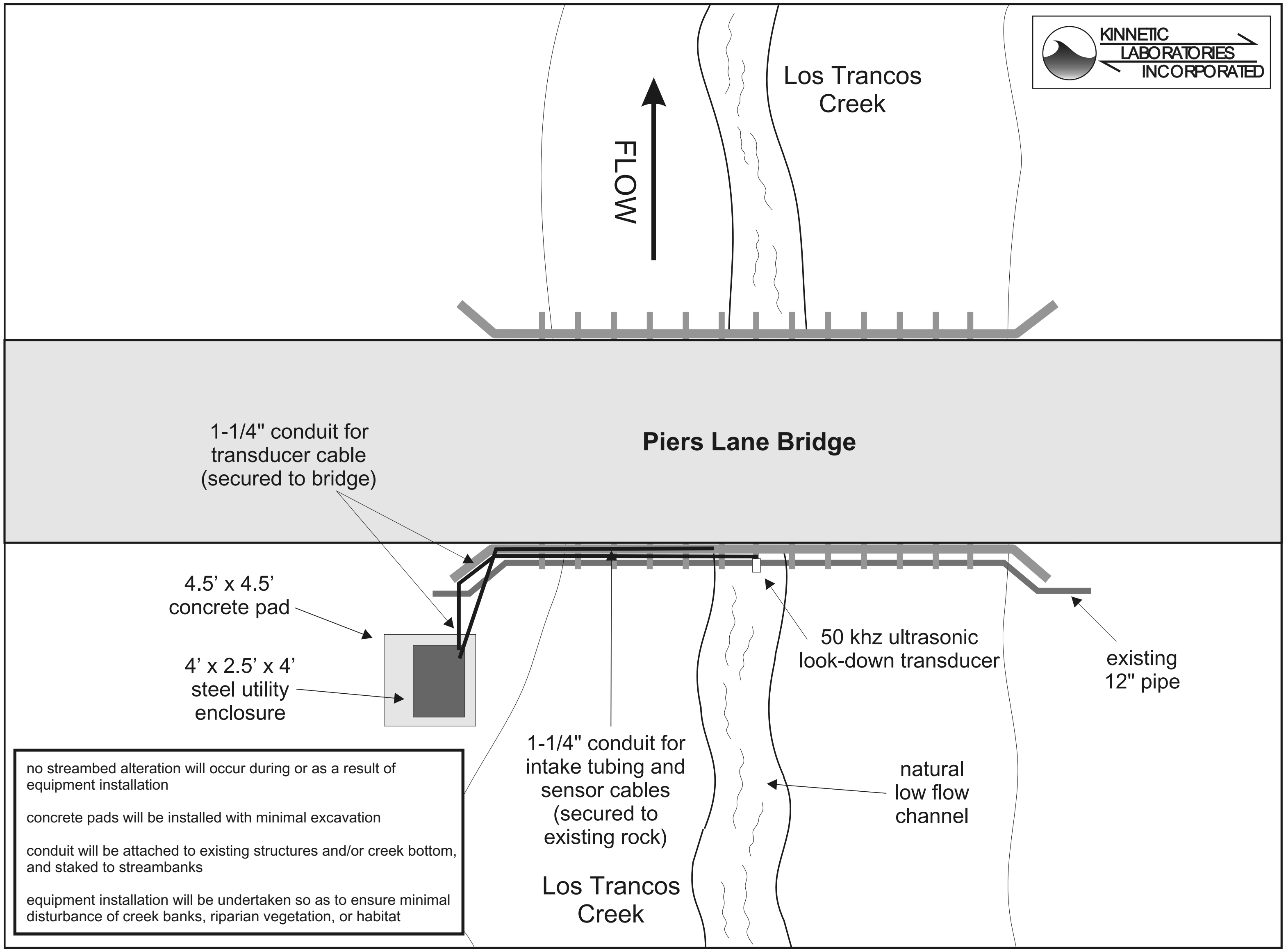
Table 4. Analyses, Methods, and Reporting Limits

ANALYSIS	METHOD	HOLDING TIME	REPORTING LIMIT
FOR ALL SITES			
Aluminum *	EPA 200.8	6 months	25 mg/L
Copper *	EPA 200.8, 1638	6 months	1 mg/L
Lead *	EPA 200.8, 1638	6 months	1 mg/L
Mercury *	EPA 1631	6 months	0.5 ng/L
Nickel *	EPA 200.8, 1638	6 months	2 mg/L
Selenium *	EPA 270.3, 1639	6 months	2 mg/L
Silver *	EPA 200.8, 1638	6 months	0.2 mg/L
Zinc *	EPA 200.8, 1638	6 months	5 mg/L
Total Hardness	EPA 130.2/SM 2340C	6 months	2 mg/L
OP-Pesticides	EPA 8141 or ELISA	7 days - extraction 40 days - analysis	0.05 mg/L
Ammonia	EPA 350.2	28 days	0.1 mg/L
Nitrate	EPA 300.0	48 hours	0.1 mg/L
Phosphorus, total	EPA 365.2	28 days	0.03 mg/L
TSS	EPA 160.1/160.2	7 days	1 mg/L
FOR NEWELL STREET SITE ONLY			
Arsenic *	EPA 206.3, 1632	6 months	0.5 mg/L
OC-Pesticides/PCBs	EPA 8081	7 days - extraction 40 days - analysis	0.01-0.5 mg/L
Dioxins and Furans	EPA 8290	7 days - extraction 40 days - analysis	1-10 pg/L

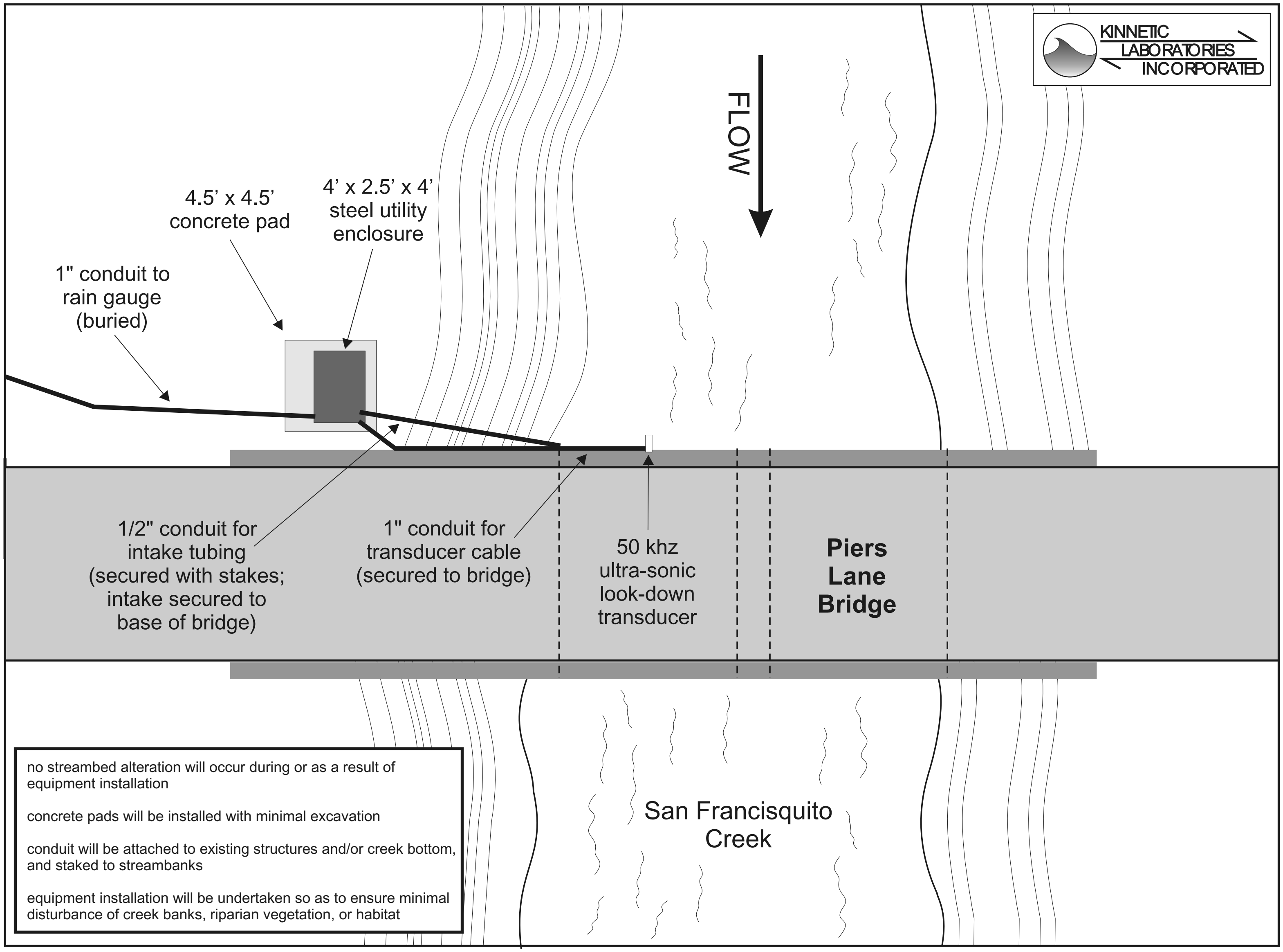
* Analyze all metals as dissolved & total (recoverable). All dissolved metals samples should be filtered on site or immediately upon arrival at the analytical laboratory, prior to preservation.



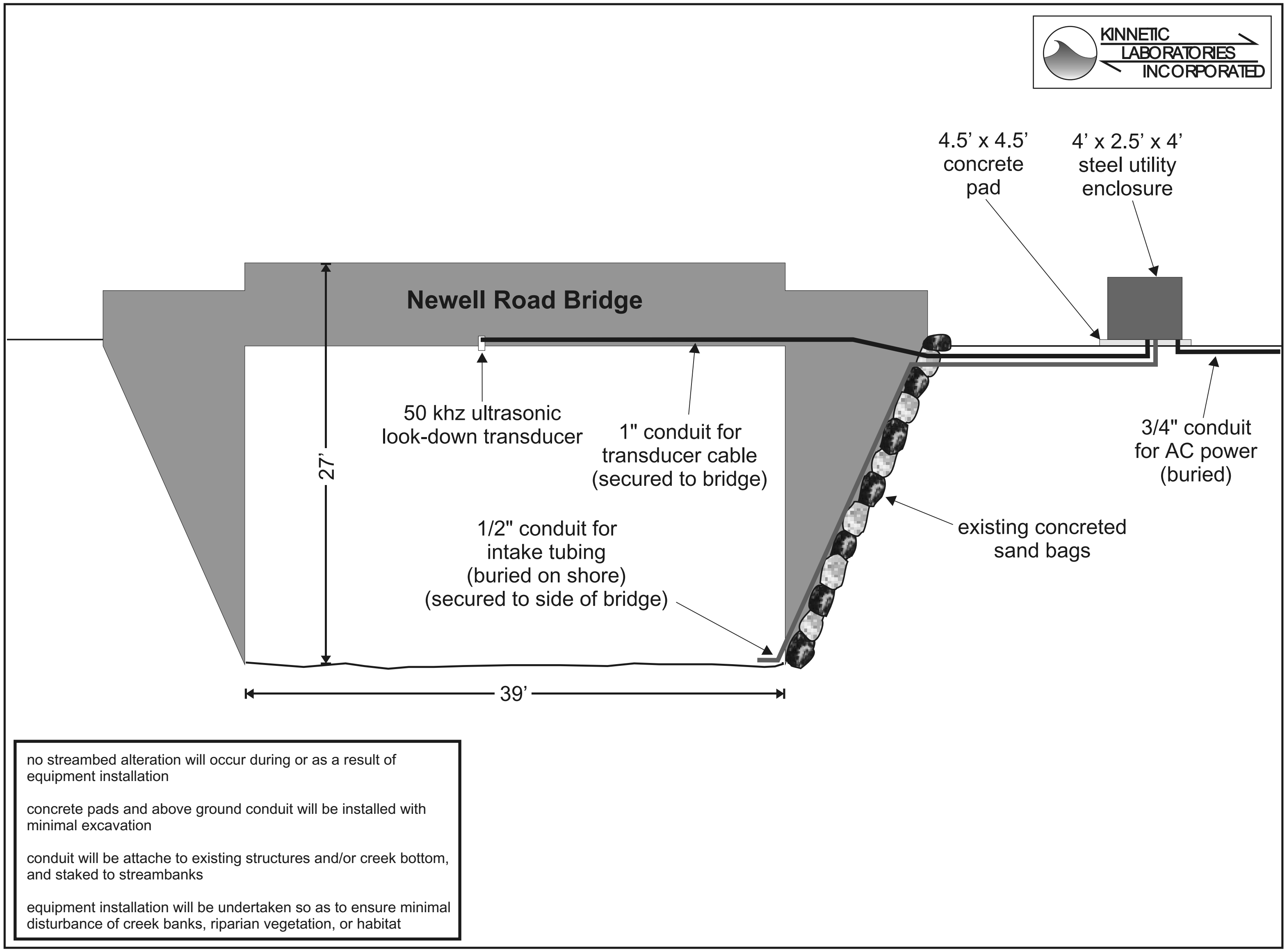
As-Built Diagram of Storm Water Monitoring Equipment on San Francisquito Creek at Newell Road Bridge (plan view).



As-Built Diagram of Storm Water Monitoring Equipment on Los Trancos Creek at Piers Lane Bridge.



As-Built Diagram of Storm Water Monitoring Equipment on San Francisquito Creek at Piers Lane Bridge.



As-Built Diagram of Storm Water Monitoring Equipment on San Francisquito Creek at Newell Road Bridge (upstream side view).

Bottle and Equipment Cleaning Procedure (Revised 9/1/98)

20L Composite Bottles (carboys)

1. Rinse bottle with warm tap water three times as soon as possible after emptying sample.
2. Soak in a 2% Liqui-Nox solution for 48 hours; scrub with clean plastic brush.
3. Rinse three times with tap water.
4. Rinse three times with metals-free Nanopure water (see Reagent and Cleaning Solutions list below), rotating the bottle to ensure contact with the entire inside surface.
5. Rinse three times with pesticide-grade methanol.
6. Rinse three times with hexane, rotating the bottle to ensure contact with the entire inside surface (use 30 ml per rinse).
7. Rinse three times with pesticide-grade methanol.
8. Rinse three times with Nanopure water.
9. Rinse three times with 2N Trace Metal HNO3 (1 liter per bottle, per rinse) rotating the bottle to ensure contact with the entire inside surface.
10. Rinse three times with Nanopure water.
11. Cap bottle with Teflon lid cleaned as specified below.

Metals Analysis Sample Bottles

1. Use only new, plastic 1.0 liter bottles.
2. Rinse three times with Nanopure water, rotating the bottle to ensure contact with the entire inside surface.
3. Rinse three times with 2N Trace Metal HNO3 (20 ml per bottle per rinse), rotating the bottle to ensure contact with the entire inside surface.
4. Rinse with Nanopure water three times.
5. Store bottles filled with 0.1% Optima HCl acid solution until ready to use.
6. Empty acid solution and rinse three times with Nanopure water before using sample bottle.

Teflon Tubing, Lids and Strainers

1. Rinse tubing three times with 2% Micro solution made with hot tap water. Wash lids and strainers with micro solution by scrubbing with a clean plastic brush.
2. Rinse three times with tap water.
3. Rinse three times with Nanopure water.
4. Rinse three times with 2N Trace Metal HNO3.
5. Soak 24 hours in 2N Trace Metal HNO3 in a clean polyethylene tub.
6. Rinse three times with Nanopure water.
7. Seal the tubing on both ends with clean powder-free nitrile, latex, or polyethylene material (e.g. glove fingers cut with non-metallic blade).
8. Individually double-bag tubing in new polyethylene bags properly labeled with date cleaned. Double-bag lids and strainers individually in zip-lock bags labeled with date cleaned.

Silicone Tubing

1. Rinse tubing three times with 2% Micro solution made with hot tap water.
2. Rinse three times with tap water.
3. Rinse three times with Nanopure water.
4. Rinse three times with a 2N Trace Metal HNO_3.
5. Rinse three times with Nanopure water.
6. Seal the tubing on both ends with clean powder-free nitrile, latex, or polyethylene material.
7. Individually double-bag tubing in new polyethylene bags properly labeled with date cleaned.

Reagents and Cleaning Solutions

- Nanopure-processed (or equivalent purification method) water should be demonstrated to be free of analyte concentrations greater than the MDL for the analytes of interest.
- 2% Liqui-Nox = 400 ml concentrated Liqui-Nox per full 20L bottle
- 2% Micro = 100 ml concentrated Micro per 5 liters of hot tap water
- Concentrated HNO_3 = Fisher brand Trace Metal Nitric Acid
- 2N Trace Metal HNO_3 = approximately1:7 dilution of Fisher brand Trace Metal Nitric Acid (16N, 71%) to Nanopure water
- Concentrated HCl = Fisher brand Optima Hydrochloric acid
- 0.1% Optima HCl acid = 2.7 ml of Fisher brand Optima Hydrochloric acid (37%) per liter of Nanopure water.

Equipment and handling

1. Safety Precautions - All of the appropriate safety equipment must be worn by personnel involved in the cleaning of the bottles due to the corrosive nature of the chemicals being used to clean the bottles and tubing. This safety equipment must include protective gloves, lab coats, chemically resistant aprons, goggles with side shields and respirators. All MSDS must be read and signed off by personnel.
2. A record book must be kept of each sample bottle washed, outlining the day the bottle was cleaned and checked off for passage of the quality control check.
3. Powder-free nitrile or latex gloves must be worn while cleaning and handling bottles and equipment. Care must be taken at all times to avoid introduction of contamination from any source.

Blank Preparation and Collection

For the following procedures, use gloves and standard "clean" glassware handling procedures. All blank containers should be appropriately labeled. A chain of custody form, including sample date and time, and requested analyses, should be completed for all samples to be analyzed. Blanks should be stored at 4˚C until extraction and analysis.

Bottle Blanks for Trace Metals Analysis

The following procedures describe preparation of bottle blanks for analysis of trace metals.

1. Pour 1 liter of metals-free Nanopure blank water into a metals sample bottle cleaned per the SOPs above, and preserve with Trace Metal grade HNO3.
2. Label as directed, and store bottle at 4˚C for 24 hours.
3. After the 24 hours have passed, analyze for trace metals of interest.

Tubing Blanks

The following procedures describe preparation of tubing blanks for analysis of EPA 625 constituents and trace metals.

Tubing blanks are collected prior to the start of the sampling season and prior to installation of suction tubing at two of the sampling sites. Tubing blanks are subjected to analysis for trace organics and total recoverable trace metals.

The following procedures should be followed for collection of tubing blanks:

1. Install the pre-cleaned pump tubing and suction tubing.
2. Pump 2 liters of Nanopure water through the tubing and discard the blank water.
3. Pump 4 liters of Nanopure water into a clean 4-liter amber glass container (or 4 – 1 liter glass bottles) for trace organics analysis.
4. Label the container(s).
5. Pump 3 liters of metals-free Nanopure water through the tubing and discard the blank water.
6. Pump 1 liter of Nanopure water into a clean one-liter plastic container for trace metals analysis.
7. Label the container.

Carboy Blank SOPs for Trace Metals Analysis

The following procedures describe preparation of carboy blanks for analysis of trace metals.

Carboy blanks to be analyzed for trace metals use Nanopure , as provided by the metals-analyzing laboratory. To perform a carboy blank (cleaning check) of the 20 L carboys, perform the following steps with a precleaned carboy or after the final rinse (step 10) of the carboy cleaning procedure (described above):

1. Fill carboy with approximately 4 liters of Nanopure blank water.
2. Cap carboy with Teflon lid cleaned as specified above, and transfer carboy to 4˚C refrigerator for 24 hours.
3. After the 24 hours have passed, aliquot 1 liter from carboy into a metals sample container cleaned per SOPs, preserve with Trace Metal HNO3, and analyze for trace metals of interest.

San Francisquito Creek Monitoring Stations Programming Instruction American Sigma 950 Flow Meter

Setup

1.0 Press 'RUN/STOP' to place the flow meter in halted mode.

1.1 Press 'MAIN MENU' key, select 'SETUP,' select 'MODIFY ALL ITEMS.'

1.2 FLOW UNITS, select 'CFS.'

1.3 LEVEL UNITS, select 'FT.'

1.4 PRIMARY DEVICE, select 'POWER EQUATION.'

1.5 POWER EQUATION LEVEL UNITS, select 'FT.'

1.6 POWER EQUATION FLOW UNITS, select 'CFS.'

1.7 POWER EQUATION: CFS = '3.252H^2.79 for Piers Lane Bridge, 12.53H^2.43 for Los Trancos Creek, and 38.21H^2.01 for Newell Road Bridge.'

1.8 PROGRAM LOCK, select 'DISABLE.'

1.9 SAMPLER PACING, select 'ENABLE.'

1.10 SITE ID, select '1, 2, or 3' for Piers Lane Bridge, Los Trancos Creek, and Newell Road Bridge, respectively.

1.11 TOTAL FLOW UNITS, select 'CF.'

Time and Date

2.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'TIME/DATE.'

2.1 Set to Pacific Standard Time (PST) in 24-hour mode; set date and year.

Advanced Options

3.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

3.1 Scroll down to COMMUNICATION SETUP, select 'MODEM SETUP.'

3.2 MODEM POWER, select 'ENABLE.'

3.3 DIAL METHOD, select 'TONE.'

3.4 PHONE NUMBER, disregard this setting.

3.5 CELLULAR MODEM SCHEDULING, select 'DISABLE.'

3.6 These steps not used: [SCHEDULE BASIS, select 'DAILY.']

3.7 [DURATION ON, select '30 MIN.']

3.8 [CELL MODEM TRIGGER, select 'DISABLE.']

3.9 PAGER OPTION, select 'DISABLE.'

3.10 Return to COMMUNICATION SETUP, select RS 232 SETUP, set baud rate to '19,200.' (Note that the baud rate of the DTU or field computer must match this setting).

3.11 DATA LOG, select SELECT INPUTS, select 'RAINFALL.' (Piers Lane Bridge only)

3.12 RAINFALL INPUT DATA, select 'LOGGED.' (Piers Lane Bridge only)

3.13 RAINFALL LOGGING INTERVAL, select '5 MIN.' (Piers Lane Bridge only)

3.14 DATA LOG, select SELECT INPUTS, select 'pH.'

3.15 pH INPUT DATA, select 'LOGGED.'

3.16 pH LOGGING INTERVAL, select '60 MIN.'

3.17 DATA LOG, select SELECT INPUTS, select 'LEVEL/FLOW.'

3.18 LEVEL/FLOW INPUT DATA, select 'LOGGED.'

3.19 LEVEL/FLOW LOGGING INTERVAL, select '5 MIN.'

3.20 DATA LOG, select SELECT INPUTS, select 'DO (dissolved oxygen in mg/L).'

3.21 LEVEL/FLOW INPUT DATA, select 'LOGGED.'

3.22 LEVEL/FLOW LOGGING INTERVAL, select '60 MIN.'

3.23 DATA LOG, select SELECT INPUTS, select 'DO TEMPERATURE (degrees C).'

3.24 LEVEL/FLOW INPUT DATA, select 'LOGGED.'

3.25 LEVEL/FLOW LOGGING INTERVAL, select '60 MIN.'

3.26 DATA LOG, select SELECT INPUTS, select 'CONDUCTIVITY (microsiemens).'

3.27 LEVEL/FLOW INPUT DATA, select 'LOGGED.'

3.28 LEVEL/FLOW LOGGING INTERVAL, select '60 MIN.'

3.29 DATA LOG, select SELECT INPUTS, select 'CONDUCTIVITY TEMP (degrees C).'

3.30 LEVEL/FLOW INPUT DATA, select 'LOGGED.'

3.31 LEVEL/FLOW LOGGING INTERVAL, select '60 MIN.'

3.32 DATA LOG, select SET MEMORY MODE, select 'WRAP.'

3.33 FLOW TOTALIZER, select MODIFY SETUP, set totalizer scaling to '1000.'

3.34 TOTAL FLOW UNITS, select 'CF.'

3.35 FLOW TOTALIZER, select 'RESET' to reset totalizer

3.36 SET POINT SAMPLING, ensure that no parameters are tagged with an arrow.

3.37 STORM WATER, select 'DISABLE.'

3.38 Start the Sigma 950 flow meter by pressing the 'RUN/STOP' key and by following the user prompts. The display must indicate that the meter is RUNNING.

San Francisquito Creek Monitoring Stations Calibration Instructions American Sigma 950 Flow Meter

Ultrasonic Level Sensor

1.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

1.1 Scroll down to CALIBRATION, select 'LEVEL SENSOR.'

1.2 Select 'ULTRA-SONIC SENSOR,' select 'CALIBRATE U-SONIC.'

1.3 ENTER AMBIENT TEMPERATURE, use an accurate thermometer to enter the air temperature.

1.4 LEVEL ADJUST, enter the staff gauge reading in feet minus the following offset: 2.00 ft for Piers Lane Bridge, 0.50 ft for Los Trancos Creek, 1.80 ft for Newell Road Bridge.

pH

2.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

2.1 Scroll down to CALIBRATION, select 'pH.'

2.2 PLACE SENSOR IN FIRST BUFFER, use 7.0 buffer, press any key.

2.3 ENTER TEMPERATURE OF LIQUID, enter the temperature of the 7.0 buffer solution.

2.3 ENTER pH FOR BUFFER #1, enter '7.0.'

2.4 PLACE SENSOR IN SECOND BUFFER, use 4.0 buffer, press any key.

2.5 ENTER pH FOR BUFFER #2, enter '4.0.'

Conductivity

3.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

3.1 Scroll down to CALIBRATION, select 'CONDUCTIVITY.'

3.2 Place the sensor and an accurate thermometer in the calibration solution (1000 microsiemens KCL conductivity standard), allow ten minutes for sensor stabilization.

3.3 Enter '0.0 ' for the TEMPERATURE CORRECTION VALUE.

3.4 Press any key, use the table on page 154 of the American Sigma 950 Flow Meter Operating and Maintenance Manual (1 July 1999) to determine the conductivity of the standard solution; be sure to multiply the value by 1000 for microsiemens, enter this value.

Conductivity Temperature

4.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

4.1 Scroll down to CALIBRATION, select 'CONDUCTIVITY TEMP.'

4.2 Place the sensor and an accurate thermometer in a liquid (bucket of water or the creek), allow ten minutes for stabilization.

4.3 Enter the actual temperature of the liquid.

Dissolved Oxygen

5.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

5.1 Scroll down to CALIBRATION, select 'DISSOLVED OXYGEN.'

5.2 ENTER AMBIENT TEMPERATURE, use an accurate thermometer to enter the air temperature.

5.3 ENTER ELEVATION, enter '200 FT' for Piers Lane Bridge and Los Trancos Creek, enter '50 FT' for Newell Road Bridge.

5.4 ENTER MEMBRANE THICKNESS, enter '2 MIL.'

5.5 ENTER CHLORINITY, enter '0.0.'

5.6 PLACE SENSOR IN AIR, place the DO sensor in open air and press any key.

Dissolved Oxygen Temperature

6.0 Press 'MAIN MENU' key, select 'OPTIONS,' select 'ADVANCED OPTIONS.'

6.1 Scroll down to CALIBRATION, select 'DISSOLVED OXYGEN TEMP.'

6.2 Place the sensor and an accurate thermometer in a liquid (bucket of water or the creek), allow ten minutes for stabilization.

6.3 Enter the actual temperature of the liquid.

San Francisquito Creek Monitoring Stations Programming and Calibration Instructions American Sigma 900 Peristaltic Pump Sampler

Basic Setup and Calibration

1 Press 'CHANGE/HALT' key to place the sampler in halted mode.

2 Press 'TIME SET' key.

3 Set to Pacific Standard Time (PST), date, and year.

4 Press the * key.

5 ALTER PARAMETERS? press 'YES/ENTER' key.

6 ENABLE ADVANCED PROGRAM? press 'NO/PASS' key.

7 NUMBER OF SAMPLE BOTTLES, select '1.'

8 ENTER UNITS FOR BOTTLE VOLUME, select 'MILLILITERS.'

9 BOTTLE VOLUME, enter '20000 ML.'

10 ENTER UNITS FOR TUBING LENGTH, select 'FEET.'

11 ENTER LENGTH OF INTAKE TUBING, enter '35 FEET' for Piers Lane Bridge, enter '45 FEET' for Los Trancos Creek and Newell Road Bridge.

12 PROGRAM LOCK, press 'NO/PASS' key.

12.1 SET SAMPLE CABINET TEMP, enter '4 DEGREES C.' (Newell Road Bridge only).

13 VERIFY PROGRAM? PROGRAM DELAY? press 'NO/PASS' key.

14 TIME MODE? press 'NO/PASS' key.

15 FLOW MODE? press 'YES/ENTER' key.

16 INTERVAL EQUALS, enter '1' counts.

17 COMPOSITE MODE? CONTINUOUS MODE? press 'YES/ENTER' key.

18 CHANGE VOLUME? press 'YES/ENTER' key.

19 SAMPLE VOLUME EQUALS, enter '250 ML.'

20 CALIBRATE VOLUME? press 'YES/ENTER' key to enter calibration routine, otherwise press 'NO/PASS' key and skip to step #21.

20.1 AUTO CALIBRATE? press 'YES/ENTER' key.

20.2 READY TO PUMP? press 'YES/ENTER' key and collect sample in a graduated cylinder.

20.3 ENTER ACTUAL VOLUME PUMPED, 'VOL PUMPED EQUALS,' enter the number of milliliters collected and press 'YES/ENTER' key.

20.4 Press the TAKE SAMPLE key to confirm correct sample volume of 250 ML (plus or minus 10 ML). If volume is incorrect, repeat Steps 20 through 20.4 (note that it may be necessary to over- or under-state the 'ACTUAL VOLUME PUMPED' to force the pump to deliver 250 ML).

21 INTAKE RINSE? press 'NO/PASS' key.

22 INTAKE FAULTS? press 'YES/ENTER' key.

23 INTAKE FAULTS EQUALS, enter '1.'

24 ENTER ID#, I.D. EQUALS, enter '1, 2, or 3 ' for Piers Lane Bridge, Los Trancos Creek, and Newell Road Bridge, respectively.

25 READY TO START, press 'START PROGRAM' key.

San Francisquito Creek Watershed
Dissolved Oxygen Calibration

STATION	DATE	TIME	AMBIENT AIR TEMP.	ELEVATION	MEMBRANE THICKNESS	CHLORINITY	LIQUID TEMP.	COMMENTS

San Francisquito Creek Watershed
Dissolved Oxygen Membrane Installations

STATION	DATE	TIME	COMMENTS

San Francisquito Creek Watershed
pH Calibration

STATION	DATE	TIME	BUFFER #1 TEMP.	BUFFER #1 PH	BUFFER #2 TEMP.	BUFFER #2 PH	COMMENTS

San Francisquito Creek Watershed
Conductivity Calibration

STATION	DATE	TIME	CALIBRATION SOLUTION	CALIBRATION SOLUTION TEMP.	CALCULATION VALUE (SEE PG. 154)	COMMENTS

[Placeholder]

Appendix F. Fiscal Year 2001/02 Matrix of Studies by Objectives

This appendix presents a matrix of current Long-Term Monitoring and Assessment studies for fiscal year 2001/02. For each overall objective, the matrix shows monitoring and assessment activities currently being conducted or planned for the San Francisquito Creek watershed in 2001/02. Descriptions of most of the current studies can be found in the SCBWMI's metadata database or the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001). For studies not listed in the Stream Studies Inventory, Appendix G presents brief project descriptions as they relate to the key questions, objectives, and assessment needs in the LTMAP.

LTMAP OBJECTIVE	MONITORING/ASSESSMENT	PARAMETERS	C1 - Distribution of Lotic Macroinvertebrates	C2 - Daily/Peak Flows	C5 - Creeks Level Monitoring	C9 - Jasper Ridge Water Quality	C10 - Fishes and Amphibians	C11 - Groundwater Recharge and Budget	C12 - Water Quality Assessment	C13 - West Union Creek Habitat/Fish Inventory	C15 - Annual Hydrologic Reports for Searsville Lake Watershed	C17 - Watershed Analysis and Sediment Reduction Plan	C18 - Storm drain mapping project	C19 - Searsville Core Sample Analysis	C20 - Sediment sampling for PCBs and mercury	C21 - Bear Gulch Water Quality Report	C24 - Development of GIS maps for San Francisquito Creek watershed	C25/C27 - Genetic Relationships Among Steelhead Rainbow Trout Populations	C26 - Comprehensive Groundwater Protection Evaluation	C28 - Stream FLow Hazards Evaluation	C29 - Long-term Water Quality Monitoring	C30 - Overland Sediment Transport Model in the Upper Watershed	C31 - Computer-based Decision Support System	C32 - Known Barriers / Impediments to Migrating Steelhead	C33 - Digital Information Resource for Fish Recovery
Physical 1 - Assess physical habitat	Derive sediment budget	Sediment quantities, areas of supply and deposition; particle size distributions										●		●								●			
	Inventory physical characteristics	Erosion, deposition, & bank stability; barriers; in-stream sediment embeddedness and sub-strate condition; riffle, run and pool structure; vegetation/ cover, and restoration success							●	●	●									●		●		●	
Assessment:	*Assess impacts on biota, habitat*	*Relate to habitat needs for key species, e.g., fish migration, & section 303(d) listing (coordinate with Biol. 1, Biol. 2)*																						●	
Physical 2 - Assess land use impacts	Compile existing and projected land use and surface drainage data	Land use boundaries, areas and watershed delineations; impervious surface data; surface drainage system layout, coverage											●				●					●			●
Assessment:	*Assess impacts of land use changes*	*Relate past and projected land use character-istics and changes to changes in surface drainage flow and quality, in-stream flow and quality, habitat, etc. (coord with Biol. 1, Biol. 2, etc.)*																							
Assessment:	*Assess impacts/effectiveness of land use policies, plans, and*	*ordinances*																							
Hydrological 1 - Assess hydrological characteristics related to flooding	Measure hydrological parameters	Rainfall, flows from tribs & discharges to SF Creek, in-stream flows, discharge to SF Bay, withdrawals (compile water rights info)	●	●	●			●	●										●						
Assessment:	*Derive hydrological characteristics*	*Rainfall/runoff and stage/discharge relation-ships; flood flows and frequencies; water budget (incl. groundwater exchange)*																	●			●			

Appendix F. Fiscal Year 2001/02 Matrix of Studies by Objectives

LTMAP OBJECTIVE	MONITORING/ASSESSMENT	PARAMETERS	C1 - Distribution of Lotic Macroinvertebrates	C2 - Daily/Peak Flows	C5 - Creeks Level Monitoring	C9 - Jasper Ridge Water Quality	C10 - Fishes and Amphibians	C11 - Groundwater Recharge and Budget	C12 - Water Quality Assessment	C13 - West Union Creek Habitat/Fish Inventory	C15 - Annual Hydrologic Reports for Searsville Lake Watershed	C17 - Watershed Analysis and Sediment Reduction Plan	C18 - Storm drain mapping project	C19 - Searsville Core Sample Analysis	C20 - Sediment sampling for PCBs and mercury	C21 - Bear Gulch Water Quality Report	C24 - Development of GIS maps for San Francisquito Creek watershed	C25/C27 - Genetic Relationships Among Steelhead Rainbow Trout Populations	C26 - Comprehensive Groundwater Protection Evaluation	C28 - Stream FLow Hazards Evaluation	C29 - Long-term Water Quality Monitoring	C30 - Overland Sediment Transport Model in the Upper Watershed	C31 - Computer-based Decision Support System	C32 - Known Barriers / Impediments to Migrating Steelhead	C33 - Digital Information Resource for Fish Recovery
Assessment:	*Define watershed features*	*Watershed boundaries, flood zones*															●								
Assessment:	*Assess flood potential*	*Use real time rainfall and creek flow data to predict flood potential*			●																				
Hydrological 2 - Assess hydrological characteristics related to habitat	Measure hydrological data from Hydro 1 for critical habitat areas, seasons	Flows from tribs & discharges to SF Creek, in-stream flows, discharge to SF Bay, withdrawals (compile water rights info)	●	●	●				●																
Assessment:	*Assess flow regimes re: habitat needs*	*Compare hydro. characteristics to habitat needs for key species (coordinate with Biol.1, Biol. 2)*					●																		
Chemical 1 - Assess known (CWA 303(d)) pollutants	Collect and analyze water samples	diazinon + field parameters: pH, temp, D.O., EC; est. Flow rate; field obs.							●												●				
	Collect and analyze sediment samples	diazinon																							
Assessment:	*Assess potential impacts on in-stream aquatic life*	*Compare observed diazinon concentrations to water and sediment quality criteria for protection of aquatic life; relate to CWA 303(d) listing, TMDLs*																							
Chemical 2 - Assess other pollutants	Collect and analyze water samples	Dissolved/total metals: Cu, Pb, Hg, Ni, Ag, Zn; hardness; TSS; NO3; NH4; P; + field parameters: pH, D.O., temp, EC; est. flow rate; field obs.				●			●						●	●					●				
		For discharge to Bay add: chlordane, DDT, Dieldrin, dioxins, furans, PCBs																			●				
Assessment:	*Assess potential impacts on in-stream aquatic life*	*Compare observed pollutant concentrations to water quality criteria for protection of aquatic life*																							
Assessment:	*Assess potential impacts on Bay water and sediment quality*	*Compare observed pollutant concentrations to recorded SF Bay levels*																							

LTMAP OBJECTIVE	MONITORING/ASSESSMENT	PARAMETERS	C1 - Distribution of Lotic Macroinvertebrates	C2 - Daily/Peak Flows	C5 - Creeks Level Monitoring	C9 - Jasper Ridge Water Quality	C10 - Fishes and Amphibians	C11 - Groundwater Recharge and Budget	C12 - Water Quality Assessment	C13 - West Union Creek Habitat/Fish Inventory	C15 - Annual Hydrologic Reports for Searsville Lake Watershed	C17 - Watershed Analysis and Sediment Reduction Plan	C18 - Storm drain mapping project	C19 - Searsville Core Sample Analysis	C20 - Sediment sampling for PCBs and mercury	C21 - Bear Gulch Water Quality Report	C24 - Development of GIS maps for San Francisquito Creek watershed	C25/C27 - Genetic Relationships Among Steelhead Rainbow Trout Populations	C26 - Comprehensive Groundwater Protection Evaluation	C28 - Stream FLow Hazards Evaluation	C29 - Long-term Water Quality Monitoring	C30 - Overland Sediment Transport Model in the Upper Watershed	C31 - Computer-based Decision Support System	C32 - Known Barriers / Impediments to Migrating Steelhead	C33 - Digital Information Resource for Fish Recovery
	Collect and analyze sediment samples	Metals: Cu, Pb, Hg, Ni, Ag, Zn													●										
		For mouth of Creek add: chlordane, DDT, Dieldrin, dioxins, furans, PCBs																				●			
Assessment:	*Assess potential impacts on Bay water & sediment quality*	*Compare observed pollutant concentrations to recorded SF Bay levels*																							
Biological 1 - Assess biological habitat	Inventory habitat conditions, including vegetation	Fish spawning/rearing sites, migration routes; macroinvertebrate habitat (lotic, benthic); bird cover/nesting sites; other?	●				●			●											●				●
Assessment:	*Assess habitat quality*	*Evaluate quality of habitat and identify stressed or impacted habitats for selected species (integrate with Phys. 1, Hydro. 1, Chem. 1, Chem 2, Biol. 2); develop vegetation map*					●																		
Biological 2 - Assess biodiversity	Field surveys to inventory key populations	Abundance (and ages) of species of interest, incl. state or federally-listed species, plus invasive species or others	●				●			●								●			●				●
Assessment:	*Assess population and community structure*	*Evaluate population structure and identify weak or missing age classes, relative abundance, community structure (trophic levels) for selected species (integrate with Phys. 1, Hydro. 1, Chem. 1, Chem 2, Biol. 1)*					●																		
Biological 3 - Toxicity testing	Collect water and sediment samples for toxicity testing	EPA 3 species test (chronic, acute); TIEs (collect samples in conjunction with sampling under Chemical 1/2)																							
Assessment:	*Assess degree and extent of toxicity*	*Identify toxic effects and sources of toxicants; evaluate seasonality (correlate with Chem. 1, Chem. 2, Biol. 1, Biol. 2)*																							

Appendix F. Fiscal Year 2001/02 Matrix of Studies by Objectives

LTMAP OBJECTIVE	MONITORING/ASSESSMENT	PARAMETERS	C1 - Distribution of Lotic Macroinvertebrates	C2 - Daily/Peak Flows	C5 - Creeks Level Monitoring	C9 - Jasper Ridge Water Quality	C10 - Fishes and Amphibians	C11 - Groundwater Recharge and Budget	C12 - Water Quality Assessment	C13 - West Union Creek Habitat/Fish Inventory	C15 - Annual Hydrologic Reports for Searsville Lake Watershed	C17 - Watershed Analysis and Sediment Reduction Plan	C18 - Storm drain mapping project	C19 - Searsville Core Sample Analysis	C20 - Sediment sampling for PCBs and mercury	C21 - Bear Gulch Water Quality Report	C24 - Development of GIS maps for San Francisquito Creek watershed	C25/C27 - Genetic Relationships Among Steelhead Rainbow Trout Populations	C26 - Comprehensive Groundwater Protection Evaluation	C28 - Stream FLow Hazards Evaluation	C29 - Long-term Water Quality Monitoring	C30 - Overland Sediment Transport Model in the Upper Watershed	C31 - Computer-based Decision Support System	C32 - Known Barriers / Impediments to Migrating Steelhead	C33 - Digital Information Resource for Fish Recovery
Biological 4 - Assess human health impacts	Collect and analyze water samples	Coliform, pathogens; + field parameters: pH, temp, D.O., EC; est. flow rate; field obs.																							
Assessment:	*Assess degree and extent of potential human health impacts*	*Identify potential exposure and effects of pathogens; evaluate seasonality (correlate with Chem. 1, Chem. 2)*																							
Social 1 - Assess community values	Survey opinions of watershed residents and users of SF Creek and related wetlands/waters	Views, opinions, concerns and activities of community members																					●		
Social 2 - Assess social characteristics of watershed	Compile social data	Demographics, income, home ownership, locations of libraries, interpretive sites and access points																							
Social 3 - Assess human impacts	Documentation of environmental change through time	Native landscape and intermediate stages from 1770s to present																							●
	Observations	Litter, encampments, recreation etc.																							

LEGEND

Italics indicate an assessment function as opposed to a monitoring function
To facilitate identifying individual studies, the following alphanumeric nomenclature is used:

C# = Current study (e.g., C29 – Long-term Water Quality Monitoring)
H# = Historical study (e.g., H22 – Allardt and Grunsky's 1888 inspection)
P# = Potential study (e.g., P15 – Long-term monitoring of upper watersheds)

To facilitate tracking studies when their status changes (e.g., from a current study to a historical study), present and past designations are shown:
H30 = C8 Adult Steelhead Passage in the Bear Creek Watershed

Study of Fishes and Amphibians of the San Francisquito Creek and Matadero Creek Watersheds (Study C10)

Sponsor

Stanford University

LTMAP Objective(s) Addressed

Hydrological 2 – Assess hydrological characteristics related to habitat
Biological 1 – Assess biological habitat
Biological 2 – Assess biodiversity

Brief Rationale for Monitoring/Assessment Project

Survey of native biotic diversity and assessment of non-native species

Overview of Monitoring or Assessment Project

Survey of San Francisquito Creek from Searsville Dam to Los Trancos Creek, Los Trancos Creek downstream of Felt Lake diversion, and Bear Creek within Jasper Ridge Biological Preserve

Tributaries - San Francisquito Creek, Los Trancos Creek, and Bear Creek

Sites – Series of points spaced approximately every 250 meters from Searsville Dam to provide spatial reference to survey data

Parameters - Conventional field metering including: pH, DO, Temperature, Turbidity, Conductivity; Biotic surveys of fish, amphibians, reptiles, and tree locations; Physical data on pool and riffle locations

Key Questions

- Is Searsville Reservoir is a source of non-native species?
- Do non-native species pose a significant threat to native species?
- Can effective methods of control of non-native species be developed and implemented?

Project Objectives

- What specific project objectives has the project been designed to address?

Quality Assurance / Quality Control

- What are the basic attributes of the QA/QC program for the study?

Follow-up/Assessments

Assessment of whether Searsville Reservoir is a source of non-native species, whether non-native species pose a significant threat to native species, and whether effective methods of control of non-native species could be developed and implemented.

Options/Additional Work

This is an ongoing project.

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Annual Hydrologic Reports for Searsville Lake Watershed (Study C15)

Sponsor

Stanford University

LTMAP Objective(s) Addressed

Physical 1 – Assess physical habitat

Brief Rationale for Monitoring/Assessment Project

Searsville Lake has significantly filled with sediment since construction of the dam that created the lake in 1892, and the present level of sediment deposition within the reservoir lies approximately 12 feet below the elevation of the Searsville Dam spillway. Associated with the sediment deposition within the reservoir has been significant sediment deposition and delta growth of the tributary streams entering Searsville Lake. Corte Madera Creek is overwhelmingly the largest source of sediment to Searsville Lake, although its watershed includes only about half of the area draining to the lake. The alluvial fan and delta complex on Corte Madera Creek has prograded significantly into Searsville Lake, and has begun to isolate Middle and Upper Searsville Lake from the Lower Searsville Lake. Flooding in the vicinity of Corte Madera Creek has become more problematic in recent years.

Overview of Monitoring or Assessment Project

Stream flow and sediment transport monitoring on tributaries to Searsville Lake

Tributaries - Corte Madera Creek, Searsville Lake, Sausal Creek, and Dennis Martin Creek

Sites – Westridge Bridge (Corte Madera Creek)

Parameters -

Key Questions

- What are the specific questions from which the project objectives and study plan were derived?

Project Objectives

- What specific project objectives has the project been designed to address?

Quality Assurance / Quality Control

- What are the basic attributes of the QA/QC program for the study?

Follow-up/Assessments

- What assessments are planned for or could be applied to the monitoring data?

Options/Additional Work

- Study H34 = C16 – Searsville Lake Sediment Impact Study
- Study P2 - Searsville Dam removal feasibility study

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Bear Gulch Water Quality Report (Study C21)

Sponsor

Cal Water

LTMAP Objective(s) Addressed

Chemical 2 – Assess other pollutants

Brief Rationale for Monitoring/Assessment Project

Under the right-to-know provisions in the 1996 Amendments to the Safe Drinking Water Act, water systems are required to provide by July 1 each year a report (consumer confidence report) to their customers that tells where their drinking water comes from and what's in it.

Overview of Monitoring or Assessment Project

Information on drinking water quality testing, sources, and number of tests conducted each year

Tributaries - Bear Gulch

Sites - Bear Gulch watershed

Parameters - Gross alpha particle activity, Al, Ba, Cl, Color, Cu, Fl, Hardness, Pb, Odor, Na, Specific conductance, Sulfate, TDS, Aldehydes, Chloropicrin, Haloacetic acids, Haloacetonitriles, Haloketones, Total organic halides (TOX), Total trihalomethanes (TTHMs), Turbidity

Key Questions

These consumer confidence reports, which USEPA developed in consultation with water suppliers, environmental groups, and the states, enable consumers to make practical, knowledgeable decisions about their health and their environment. Water systems in California and many metropolitan areas already provided reports containing some of this information. The annual reports are not meant to be the primary notification of potential health risks posed by drinking water, but will provide customers with a snapshot of their drinking water supply.

Project Objectives

Each report must provide consumers with the following fundamental information about their drinking water:

- the lake, river, aquifer, or other source of the drinking water;
- a brief summary of the susceptibility to contamination of the local drinking water source, based on the source water assessments that states are completing over the next five years;
- how to get a copy of the water system's complete source water assessment;
- the level (or range of levels) of any contaminant found in local drinking water, as well as EPA's health-based standard (maximum contaminant level) for comparison;
- the likely source of that contaminant in the local drinking water supply;
- the potential health effects of any contaminant detected in violation of an EPA health standard, and an accounting of the system's actions to restore safe drinking water;†
- the water system's compliance with other drinking water-related rules;
- an educational statement for vulnerable populations about avoiding Cryptosporidium;
- educational information on nitrate, arsenic, or lead in areas where these contaminants are detected above 50% of EPA's standard; and
- phone numbers of additional sources of information, including the water system and EPA's Safe Drinking Water Hotline (800-426-4791).

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Quality Assurance / Quality Control

Certified laboratories use standard QA/QC methods in conducting analyses.

Follow-up/Assessments

Drinking Water Source Assessment and Protection Plan (DWSAPP) – If additional assessments were warranted, SFPUC has prepared a report that describes its watersheds and water supply system, identifies potential sources of contamination in the watersheds, discusses the existing and recommended watershed management practices that protect water quality, and summarizes the water quality monitoring conducted.

Options/Additional Work

Annual monitoring and reporting as required by law.

Development of GIS Maps for San Francisquito Creek Watershed (Study C24)

Sponsor

USGS / San Francisquito Watershed Council

LTMAP Objective(s) Addressed

Physical 2 – Assess land use impacts
Hydrological 1 – Assess hydrological characteristics related to flooding

Brief Rationale for Monitoring/Assessment Project

Although some of the agencies that operate in the watershed have mapped or are in the process of mapping portions of the watershed on geographic information systems, the details of the GIS systems vary jurisdiction-to-jurisdiction.

Overview of Monitoring or Assessment Project

Provide assistance in developing an information management system (including GIS and maps) for the San Francisquito Creek watershed that: 1) includes a link to the SCBWMI public access data repository, and 2) is as consistent as possible with similar systems being developed by the Regional and State Board

Tributaries – San Francisquito Creek watershed

Parameters – Parameters that may be provided via Potential Study #9 (i.e., P9) plus others: Land area/watershed delineation; Land use types; Development history; Population; Schools/Educational institutions; Municipal resources; Community resources and organizations; Local media outlets; Creek characteristics; Natural and ecological history

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Key Questions

Where are the major watershed features located such as: watershed and jurisdictional boundaries; waterbodies; major roads; schools, parks, libraries, and churches; topographic lines and fault traces; land use types, population distribution, and flood areas?

Project Objectives

- To provide a consistent set of graphics (maps and photographs) that stakeholders agreed were sufficiently accurate and detailed to use to depict watershed features that are important to various watershed plan implementers, and for communications with†decision-makers and the community.
- Make georeferenced spatial data analysis possible.

Quality Assurance / Quality Control

- Source data criteria (e.g., scale) and quality standards
- Complete and accurate documentation of source data
- Cross-checking of data to identify discrepancies and errors
- Established updating and access protocols

Follow-up/Assessments

Flooding Map Update and Basic Hydrology study - Provides hydrologic and hydraulic analysis on District creeks, dam and reservoir systems, and capital improvement projects (SCVWD)

Options/Additional Work

- Study P2 – Storm drain mapping project in San Mateo County
- San Francisquito Creek Watershed Enhancement Program (CALFED grant includes mapping work)
- Compile / create other parameters from the Watershed Science Approach that are contemplated for a complete GIS

Long-term Water Quality Monitoring (Study C29)

Sponsor

City of Palo Alto / Stanford University /
San Francisquito Watershed Council

LTMAP Objective(s) Addressed

Chemical 1 – Assess known pollutants
Chemical 2 – Assess other pollutants
Biological 1 – Assess biological habitat
Biological 2 – Assess biodiversity

Brief Rationale for Monitoring/Assessment Project

Diazinon (a widely-used organophosphate pesticide) and sediment have been listed as causes of impairment to San Francisquito Creek quality in the most recent (1998) CWA Section 303(d) list, and are therefore considered to represent known pollutants. Other potential pollutants in San Francisquito Creek include heavy metals, nutrients, other pesticides, and PCBs. The overall purpose of this monitoring program is to characterize wet season water quality at key locations within or tributary to San Francisquito Creek.

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Overview of Monitoring or Assessment Project

Long-term monitoring of water quality at fixed stations to characterize wet season conditions

Tributaries – San Francisquito Creek and Los Trancos Creek

Sites – Three sites - San Francisquito Creek @ Newell, @ Piers Lane; Los Trancos Creek @ Piers Lane

Parameters – Dissolved/total metals – Al, Cu, Pb, Hg, Ni, Se, Ag, Zn; Hardness; TSS; Nitrate; Ammonia; Phosphorous; Diazinon & Chlorpyrifos; Field parameters – pH, DO, Temperature, Conductivity, estimated Flow rate; Field observations / Newell station only add – As, OC pesticides (Chlordane/Dieldrin/DDT); PCBs; Dioxins/Furans; Macroinvertebrates

Key Questions

- What are the in-stream levels of the parameters listed as causes of impairment on the Section 303(d) list for San Francisquito Creek (diazinon, sediment), and what are the sources of the observed in-stream levels?
- Are the 303(d)-listed pollutants or other pollutants present in the creek at levels that may be toxic to aquatic life or that exceed California Toxics Rule (CTR) standards?
- How does water quality change as the Creek flows through the urbanized area (from below Searsville dam to San Francisco Bay)?
- How does Creek water quality vary temporally (diurnally, within rainfall/runoff events, from one rainfall/runoff event to another, seasonally as the wet season progresses, and annually)?
- What are the annual loadings of key pollutants from San Francisquito Creek to San Francisco Bay?

Project Objectives

1. Characterize San Francisquito Creek water quality for key constituents at a location downstream of the urban area but upstream of tidal influence.
2. Characterize San Francisquito Creek water quality for key constituents at a location upstream of the urban area.
3. Characterize the major inputs to the Creek for key constituents in the intervening reach between the urban area downstream and upstream sites.
4. Provide information that can be used in other ongoing or planned studies within the watershed and coordinate with those studies to the extent practical.

Quality Assurance / Quality Control

Monitoring will include automated composite sampling at sites 1-3, with grab sampling for specific constituents where required by USEPA protocols. All sample collection will be done using “clean techniques.” Analysis will include low-level methods for trace metals and organic compounds. A comprehensive QA/QC program will be implemented to cover both field and laboratory procedures. The QA/QC program is patterned after the Sampling and Analysis Plan in Appendix D.

Follow-up/Assessments

- Assessments of the monitoring data will include:
- comparisons of Creek water quality to California Toxics Rule standards,
- comparisons of San Francisquito Creek water quality upstream and downstream of the urban area,
- identification of sources of spatial changes in water quality (this will involve evaluation of data from this program and others, including monitoring conducted by the Stanford Linear Accelerator Center and Stanford University), and
- evaluations of temporal variability and trends.

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Options/Additional Work

- Study P15 – Long-term monitoring of Searsville Lake, Bear Creek, and Corte Madera Creek subwatersheds
- Study P16 – Toxicity testing (this mainly requires collection of a whole bunch of extra water and some extra expense, which becomes more significant if Toxicity Identification Evaluations are included)
- Study P22 – Collect and analyze water samples for indicators of human health impacts
- Sediment monitoring (this requires gaining personnel access to the Creek, which presents some logistical difficulties re: personal safety during wet weather)
- Cross-sectional variability testing (while the relatively narrow configuration of the Creek and—especially at Newell bridge—the steepness of the creek channel indicate that the Creek water will be fairly well-mixed, some testing of cross-sectional variability could be done to verify whether such variability is significant, using field-measured parameters).
- Water quality monitoring for selected urban runoff discharges to San Francisquito Creek within the urban area

Overland Sediment Transport Model in the Upper Watershed (Study C30)

Sponsor

USGS

LTMAP Objective(s) Addressed

Physical 1 – Assess physical habitat
Physical 2 – Assess land use impacts
Hydrological 1 – Assess hydrological characteristics related to flooding
Chemical 2 – Assess other pollutants

Brief Rationale for Monitoring/Assessment Project

Thousands of communities in small watersheds across the nation are or will be facing issues of flooding, habitat restoration, aging dams, and stream impairment by sediment and pollutants from non-point sources. There is an immediate need to develop a decision support system based on sound science that incorporates community values that will help inform decisions on these issues. These issues are vexing decision-makers in San Francisquito Watershed, California.

Overview of Monitoring or Assessment Project

Investigation of erosion and sediment transport processes within the headwater areas of the watershed, and development of a model linking changes in land use to changes in sediment supply. The project's simulation modeling will concentrate on watershed hydrology, particularly on overland flow resulting from a storm event, rather than on channelized flow within the stream system. An investigation is being conducted of sediment erosion and deposition occurring in the tidal influenced reaches of the creek. The principal objective of this study is to identify and delineate past flood events.

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Tributaries – San Francisquito Creek watershed

Sites - Upper watershed and tidally influenced reaches; Sediment cores - Transect of post-1930 delta from high upper tidal to lower tidal and pre-1930 to circa 1500 tidal delta

Parameters - Watershed land use/landscape change – rainfall, synthetic daily discharge hydrographs, sediment discharge volume estimates, vegetation cover, land use, annual evapotranspiration change and soil erosion rate change models; Modeling of downstream sediment transport; Sediment cores – 210Pb and 14C dating, introduced microfauna and macrofauna, sediment textural and carbon studies, diatom census studies, pesticides

Key Questions

- What has been the effect of land use change in contributing sediment to the reservoir and on landscape change?
- Is the watershed impaired with regard to sediment?
- What impact will this sediment have on the carrying capacity of the creek and aquatic habitat? How can the multiple uses of an urbanized watershed be managed to minimize impact to the ecological habitat?

Project Objectives

A major goal of the Creek Project is development of a computer-based decision support system (DSS) that will be of use for long-term land use planning to communities in the San Francisquito Creek watershed. At the heart of an effective DSS are predictive models that can show the probable range of outcomes of different policy options. The particular focus of the current effort is investigation of erosion and sediment transport processes within the headwater areas of the watershed, and development of a model linking changes in land use to changes in sediment supply.

Quality Assurance / Quality Control

To be determined

Follow-up/Assessments

Watershed land use/landscape change modeling

Options/Additional Work

To be determined

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Computer-based Decision Support System (DSS) (Study C31)

Sponsor

USGS

LTMAP Objective(s) Addressed

Social 1 – Assess community values

Brief Rationale for Monitoring/Assessment Project

The purpose is to empower citizens to use USGS science to help with decisions that affect the quality of their lives.

Overview of Monitoring or Assessment Project

Explore the role of science, scientists, and scientific analysis in negotiations regarding the management of environmental resources. An educational component will focus on working with school groups to test, evaluate, and learn from communities' experiences with using science in collaborative processes to resolve environmental issues. The educational element is designed to (1) raise community awareness of environmental problems within the watershed and (2) actively engage the community in the decision-making process. During the first year (March 1 to October 1, 2001), project team members will design training materials for teachers, develop an exhibit for the USGS Western Region Visitor Center, and interview stakeholder groups.

Tributaries – San Francisquito Creek watershed

Sites – Not Applicable

Parameters – Not applicable

Key Questions

- How do we connect people and science so that science becomes an integral part of decisions?
- How can the scientific findings be effectively communicated to decision-makers?
- How can the competing interests be reconciled to achieve balanced solutions to land use and environmental policy?

Project Objectives

The overarching objective is to formulate a series of guidelines that would assist the local officials in involving stakeholders in the design and implementation of research about the San Francisquito Creek watershed. Creating a coherent Decision Support System that integrates the many different aspects of the creek will allow users to assess the complex nature of the creek and, ideally, propose a more comprehensive strategy to attain their end goals rather than piece-by-piece policy formulation without regard to the interrelated character of the creek.

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Quality Assurance / Quality Control

The quality of the DSS will be enhanced by:

- anticipating the decision-makers' information requirements, including such constraints as required scale, precision, and unit boundary definitions
- collaboratively deciding on the exact questions that need to be asked
- clearly articulating specific goals and desired results
- managing (minimizing and documenting) uncertainty and error

Follow-up/Assessments

The following "assessments" are planned as part of developing the DSS:

- Science Summary Report presenting analysis of San Francisquito Creek watershed dynamics based on currently available data
- Written report for distribution to project partners presenting preliminary DSS design, including requirements, constraints, options, and reasons for each
- End-user feedback, DSS revision, and GIS layer adjustment

Options/Additional Work

Ongoing process of feedback and continuous improvement

Known Barriers / Impediments to Migrating Steelhead (Study C32)

Sponsor

San Francisquito Watershed Council

LTMAP Objective(s) Addressed

Physical 1 – Assess physical habitat

Brief Rationale for Monitoring/Assessment Project

Habitat loss and reduced connectivity associated with migration barriers and impediments is a major limiting factor for the watershed's steelhead and rainbow trout population. This project is the necessary first step to improving steelhead migration and providing access to additional habitat within the watershed.

Overview of Monitoring or Assessment Project

Identification and assessment of migration barriers and impediments to adult steelhead in the San Francisquito Creek watershed including associated tributaries (The project is also addressing migration barriers to the native rainbow trout population upstream of Searsville Dam to improve habitat connectivity for this unique population)

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Tributaries – All including San Francisquito Creek, Los Trancos Creek, E. Los Trancos Creek, Bear Creek, Dry Creek, Bear Gulch, West Union Creek, Squealer Gulch, McGarvey Gulch, Tripp Gulch, Appletree Gulch, Corte Madera Creek, Sausal Creek, Dennis Martin Creek, Alambique Creek, Bull Run Creek, Neils Gulch, Bozzo Gulch, Hamms Gulch, Jones Gulch, Damiani Creek, Rengstorff Gulch, Coal Creek, and other small tributaries off Sausal Creek.

Sites – At least 29 sites

Parameters – Creek, name/barrier type, location, owner, severity, priority, notes and possible actions

Key Questions

- How many migration barriers exist in the watershed?
- Where are they located?
- How severe (difficult) are they to migrating steelhead/rainbow trout?
- Who owns the structures?
- What can be done to improve/facilitate steelhead passage at the structure?
- What resources are available to implement recommended action?

Project Objectives

Project objectives have been designed to carry out several actions identified by the San Francisquito Creek Steelhead Technical Task Force as necessary for improving habitat conditions for steelhead trout. This project's objectives are to:

- identify migration barriers and impediments to steelhead,
- assess the degree of migration difficulty,
- identify the structures' owners,
- develop recommendations for improving/facilitating passage,
- identify possible resources to implement recommended actions, and
- coordinate and oversee the implementation of recommended actions.

Quality Assurance / Quality Control

- Utilize qualified professionals to identify and assess barrier/impediment conditions and develop recommended actions
- Project oversight by the San Francisquito Watershed Council's Steelhead Technical Task Force
- The Steelhead Technical Task Force will conduct monthly updates and oversee project implementation

Follow-up/Assessments

Ongoing monitoring of project sites to ensure proper maintenance and effectiveness.

Options/Additional Work

Study P28 – Site-specific follow-up studies on priority barriers that need more evaluation before retrofit or removal. Further analysis of certain structures will need to be carried out by qualified engineers and additional assessment work may be required by the Department of Fish and Game and other entities.

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Digital Information Resource for Fish Recovery (Study C33)

Sponsor

National Marine Fisheries Service / State of California

LTMAP Objective(s) Addressed

Physical 2 – Assess land use impacts
Biological 1 – Assess biological habitat
Biological 2 – Assess biodiversity
Social 3 – Assess human impacts

Brief Rationale for Monitoring/Assessment Project

Over the last 100 years, populations of steelhead and salmon have declined to about five to ten percent of historic levels. Unless recovery actions on a systematic basis begin in the near future, the long-term status of these fish is highly questionable.

Overview of Monitoring or Assessment Project

Production of a digital information resource for use in developing a recovery plan for salmon and steelhead that are listed as threatened under the Endangered Species Act

Tributaries – San Francisquito Creek Watershed

Sites – Not applicable

Parameters – Migration barriers; timber harvest; agricultural impacts; urban growth; long-term management plans; environmental conservation and restoration activities; habitat conditions and limiting factors; salmonid population presence, abundance, and distribution; historical habitat trends; thematic mapping; land cover/land use assessment; socio-economic analyses

Key Questions

- Critical elements to salmonid recovery include:
- Limiting factors for recovery/factors for decline
- Fishery population data
- Habitat typing and current condition
- Restoration activities and degree of effectiveness
- Cost/benefit information for restoration alternatives
- Existing conservation or recovery-related strategies
- Projected impacts of recovery actions on local economies
- Requirements for future infrastructure maintenance or expansion
- Integrating the requirements of various statutes
- Essential Fish Habitat (EFH)

*Only those not in the *Inventory of Santa Clara Basin Stream Studies* (SCBWMI, 2001)

Project Objectives

To assemble all relevant and available spatial and non-spatial data necessary to support assessment and decision-making by natural resource managers to plan for and implement actions leading to the recovery of listed salmonids

Quality Assurance / Quality Control

All data that is incorporated or developed for this project will undergo peer review by contributing agencies and organizations. Data that is generated by this project will meet all national mapping accuracy standards. All metadata associated with the project data set will be compliant with standards set forth by the Federal Geographic Data Committee.

Follow-up/Assessments

- Characterize the geographic study area, including an analysis of data gaps, determination of the resulting initial scale of the landscape characterization, data gap filling, and spatialization of selected non-spatial datasets and generation of new datasets
- Development of customized modeling and analysis applications in support of recovery and restoration. Modeling applications including suitability mapping and decision-making scenarios for the assessment of factors necessary to facilitate the recovery and de-listing of salmonid species. Modeling applications will take into account the factors needed to evaluate planning alternatives in subject watersheds, evaluate present and future expected conditions, and include the ability to make real-time, site-specific recommendations for management actions.

Options/Additional Work

- What additional monitoring or assessments could be used to supplement or follow up on the planned project?

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Appendix H. Fiscal Year 2000/01 Accomplishments

Studies completed:

- Assessment of Water Quality in Urban and Rural Stormwater Runoff
- Geomorphic Study of Searsville Lake Watershed
- Adult Steelhead Passage in the Bear Creek Watershed
- Fishes and Amphibians of the San Francisquito Creek and Matadero Creek Watersheds
- San Francisquito Creek Existing Conditions Report and Bank Stabilization and Revegetation Master Plan
- Data Report for Water Year 1999: Annual Hydrologic Record and Sediment Yield, Corte Madera Creek
- Searsville Lake Sediment Impact Study
- Topographic Survey and Hydraulic Modeling
- Defining Watershed Delineations
- Effects of County Land Use Policies and Management Practices on Anadromous Salmonids and Their Habitats
- Annual Hydrologic Record and Preliminary Sediment Budget for Los Trancos Creek above Stanford's Felt lake Diversion

Long-term surface water quality monitoring stations installed:

#1 – San Francisquito Creek @ Newell

#2 – San Francisquito Creek @ Piers Lane

#3 – Los Trancos Creek @ Piers Lane